An investigation of how South African Small and Medium Enterprises use ICT and Dynamic Capabilities to achieve competitive advantage

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IS Master's Dissertation

Presented to

The Department of Information Systems

In partial fulfillment of the requirements for the degree
Master of Commerce (MCom) in Information Systems

By

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August 2011

Dedication

I dedicate this research work to my lovely parents, *Prince and Mrs. James Ajibade Adeniran*.

I couldn't have asked for better parents and I wouldn't want to, because you are just the best.

From the bottom of my heart, I say thank you for your prayers and support.

Acknowledgement

My gratitude goes to Almighty God who has always been there for me; He sustained and kept me throughout my study at the University of Cape Town. The unforgettable experience gained from, and guidance shown to me by, my supervisor, *Professor Kevin Johnston*, is well appreciated and all the contributions and advice of *Professor Michael Kyobe, Professor Mike Hart, Professor Irwin Brown* and *Professor Wallace Chigona* went a long way in accomplishing this task.

I want to appreciate and applaud the efforts, support and love of my parents and siblings – I am indeed grateful to you all. My sincere appreciation goes to Engineer Olayinka Oladimeji for his support.

I thank all my flatmates and friends whose marvelous and incredible spirit remain indelible in my heart, in the persons of *Mr. Abiodun Ogunyemi, Mrs. Olutayo Boyinbode, Dr. Nwamaka Ukomadu, Miss Oluwatoyin Adeleke, Mr. & Mrs. Felix Bankole, Mr. Oluwaseun Ogunmodimu* and many more faceless angels of mercy who have dotted my path to ensure the successful completion of this challenge.

I want to voice appreciation for *the chosen one, Oluwaseun Aduragbemi Ogundipe* for his patience, support, encouragement and uncompromising love during this program. I have been to places, yet I have found no one like you. I am indeed grateful.

Adeniran, Tejumade Victoria

August 2011

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Abstract

This study sets out to investigate how South African Small and Medium Enterprises (SMEs) use Information and Communication Technology (ICT) and Dynamic Capabilities (DCs) to achieve competitive advantage in a changing business environment. The study explores the purposes for which South African SMEs use ICT in a changing environment, as well as the types of organisational capabilities or DCs that can significantly impact on competitive advantage within the SMEs. This study examines the contingent effect of firm size and age on the ICT capabilities, ICT utilisation, and absorptive and innovative capabilities of South African SMEs.

Research has shown that SMEs serve as the backbone for the South African economy by contributing approximately 35% to the national gross domestic product (GDP). SMEs are classified as having less than 250 employees. SMEs play a crucial role in job creation, investment and income generation, as well as poverty alleviation. SMEs are significant in their contributions to economic growth, innovation of new products, technological progress and competitive advantage.

However, SMEs are characterised by limited ICT capabilities and limited human and financial resources, and are often faced with competitive forces which threaten their survival. The failure rate of SMEs is much higher than that of larger organisations. SMEs in South Africa fail at a rate of between 70% and 80%. The potential of ICT to provide SMEs with competitive advantage in changing environments has been a topic of interest to managers and researchers, as ICT is one of the ways whereby SMEs can improve products and business processes, in order to combat pressures from competitors. SMEs need DCs to achieve competitive advantage in fast changing business environments.

Empirical research on SMEs' ICT and DCs from developing countries has not yet received wide attention. Research on DCs has been on a piecemeal basis, as a universally recognised definition of DC is yet to emerge. A number of scholars have argued that DCs alone cannot significantly impact on competitive advantage or improve a firm's performance, while others disagree. More studies are required to understand the types of organisational capabilities or DCs that will have significant impact on competitive advantage within the SMEs.

To achieve the objectives of this study, an attempt was made to firstly describe:

What gives South African SMEs a competitive advantage in dynamic environments?
How are South African SMEs using ICT in dynamic environments?
What is the contingent effect of firm size and age on the ICT capabilities?

Secondly, a framework was developed to address five exploratory research questions:
How do ICT utilisations impact on competitive advantage of South African SMEs in dynamic environments?
How do ICT utilisations impact on dynamic capabilities of South African SMEs in dynamic environments?
What types of dynamic capabilities will significantly impact on competitive advantage within the South African SMEs in dynamic environments?
How do dynamic capabilities impact on ICT utilisations of South African SMEs in dynamic environments?
What is the contingent effect of firm size and age on ICT utilisations, absorptive and innovative capabilities?

Data was collected through an online based semi-structured questionnaire from individuals responsible for Information Technology (IT) of South African SMEs. The statistical evidence gathered shows that South African SMEs are high users of ICT. The findings indicate that technology related firms (in the Manufacturing and ICT sectors) use more advanced technology than non-technology related firms, and that the level of ICT usage within South African SMEs is sector specific. It was found that a firm's size has significant impact on ICT capabilities, with medium sized firms having Advanced Information Technology (AIT) capability. A firm's age also impacts on the level of ICT capability of South African SMEs – the more mature firms have AIT capability. Firm size and age were also found to have significant impacts on innovative capability.

In addition, it was found that ICT utilisation has significant and positive impacts on competitive advantage and DCs. The ability of ICT to provide SMEs with competitive advantage lies in its usage and not just merely by possessing ICT tools, applications or functions. It was also found that sensing, integrative and behavioural capabilities are part of DC constructs: this study extends the used four DC constructs (absorptive, adaptive, innovative and networking capabilities) to include sensing, integrative and behavioural capabilities. The findings show that all the DC constructs specified in this study have

significant impacts on competitive advantage, and that DCs are capable of influencing SMEs' Valuable, Rare, Inimitable and Non-substitutable (VRIN) resources to achieve competitive advantage in a fast changing business environment.

It was also found that DCs have significant and positive impacts on ICT utilisation. DCs can assist SMEs to generate long-time returns on ICT applications, functions and tools in a changing environment, ahead of rivals. The findings finally indicate that, while firm size has significant impacts on innovative capability, firm age does not, and size and age do not show any significant impacts on ICT utilisation and absorptive capability. Based on the findings, recommendations are made for future research and for practice.

Keywords: competitive advantage, Dynamic Capabilities (DCs), Small and Medium Enterprises (SMEs), Information and Communication Technology (ICT) capabilities

List of acronyms and abbreviations

AC	Advanced Communication
AIT	Advanced Information Technology
BC	Basic Communication
BIT	Basic Information Technology
CRM	Customer Relation Management
DCs	Dynamic Capabilities
ERP	Enterprise Resource Planning
GDP	Gross Domestic Product
ICT	Information and Communication Technology
PLS	Partial Least Square
RBV	Resource-Based View
SCP	Structure Conduct Performance
SEM	Structural Equation Modelling
SMEs	Small and Medium Enterprises
VoIP	Voice over Internet Protocol
VRIN	Valuable, Rare, Inimitable and Non-substitutable

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1. Introduction

This study aims to investigate how South African Small and Medium Enterprises (SMEs) use Information and Communication Technology (ICT) and Dynamic Capabilities (DCs) to achieve competitive advantage in fast changing business environments; it also investigates the significant impacts of ICT utilisation and DCs on the competitive advantage (innovativeness) of South African SMEs. This study attempts to cover SMEs in as many parts of South Africa as possible.

1.1. Why study SMEs' capabilities for competitive advantage

SMEs serve as the backbone for the South African economy by contributing approximately 35% to the national gross domestic product (GDP) (AMTS, 2002; Fatoki & Smit, 2011; Johnston, Kabanda, Adams & Davids, 2008; Sawers, Pretorius & Oerlemans, 2008). SMEs play a crucial role in job creation, investment, income generation as well as poverty alleviation (Abor & Quartey, 2010; Berry, Von Blottnitz, Cassim, Kesper, Rajaratnam & Van Seventer, 2002; Frempong, 2007; Indarti & Langenberg, 2008; Nieto & Fernandez, 2006). SMEs are the main drivers of innovation and economic development of most developing countries, while innovation is the main source of competitive advantage (Crossan & Apaydin, 2009; Dess & Picken, 2000; Donner, 2007; Kotelnikov, 2007; Wang & Ahmed, 2004). Duan, Mullins, Hamblin, Stanek, Sroka & Machado, (2002) established that SMEs are vital to the economic stability of nations.

However, the failure rate of SMEs is much higher than that of large organisations (Terziovski, 2010). South African SMEs fail at the rate of between 70% and 80% (Fatoki & Smit, 2011; Van Eeden, Viviers & Venter, 2003). SMEs need more than ordinary capabilities in dynamic environments (Kotelnikov, 2007; Lindblom, Olkkonen, Kajalo & Mitronen, 2008), and will need to combine ICT with DCs to achieve competitive advantage in fast changing business environments (Lindblom *et al.*, 2008).

For the benefit of this study, ICT utilisation is the ability of a firm to use ICT applications and functions, DCs are organisational processes purposefully designed to alter the "firm's resource base", and competitive advantage is the ability of a firm to deploy valuable processes and resources, not implemented by the competitors. Thus, this study aims to investigate how South African SMEs use ICT and DCs to achieve competitive advantage in changing business environments, and the significant impacts of ICT utilisation and DCs on the competitive advantage of South African SMEs.

1.2. Background

SMEs have limited resources**;** they thus need to combine ICT with DCs to remain competitive. Although, a number of studies have been done on DCs, very little work has investigated the impacts of ICT utilisation and DCs on competitive advantage. A number of scholars have argued that DCs alone cannot significantly impact on competitive advantage, or improve a firm's performance (Eisenhardt & Martin, 2000; Zahra, Sapienza & Davidsson, 2006), while others disagree (Teece, 2007; Zollo & Winter, 2002). This disagreement has impeded the progress of empirical studies of the DCs (Easterby-Smith, Lyles & Peteraf, 2009). Even though DC has received attention from scholars in different research fields, a universally recognised definition of DC is yet to emerge (Easterby-Smith *et al.*, 2009), and DC studies remain conceptual and theoretical (Ambrosini & Bowman, 2009; Zhou & Li, 2010). Research on DC has been on a piecemeal basis (Wang & Ahmed, 2007), and empirical studies of DC are rare (Ambrosini & Bowman, 2009; Narayanan, Colwell & Douglas, 2009). Empirical research on SMEs' ICT and DCs from a developing countries context has not received wide attention (Parida, 2008). More empirical studies are required to understand the types of organisational capabilities and DCs to achieve and maintain competitive advantage within SMEs, and the impact of ICT utilisation and DCs on competitive advantage (Borch & Madsen, 2007).

Since SMEs' ability to compete has a great impact on national development, this study investigates how South African SMEs use ICT and DCs to achieve competitive advantage in dynamic environments, and the significant impacts of ICT utilisation and DCs on the competitive advantage of South African SMEs.

According to Kew and Herrington (2009), newly established firms have fewer customers and possess limited ICT capability, compared to well establish firms. Sawers *et al.*, (2008) noted that medium sized firms generally have greater capabilities than small firms. This study will attempt to also investigate the contingent effects of firm size and age on ICT capabilities, ICT utilisation and two of DCs capabilities (absorptive and innovative) of South African SMEs.

1.3. The research questions

This research was guided by the primary research question: How are South African SMEs using ICT and Dynamic Capabilities to achieve competitive advantage? To achieve the objective of this study, an attempt was made to firstly describe:

- What gives South African SMEs competitive advantage in dynamic environments?
- How are South African SMEs using ICT in dynamic environments?
- What is the contingent effect of firm size and age on the ICT capabilities?

Secondly, the following exploratory research questions were asked:

1. How do ICT utilisations impact on competitive advantage of South African SMEs in dynamic environments?
2. How do ICT utilisations impact on dynamic capabilities of South African SMEs in dynamic environments?
3. What types of dynamic capabilities will significantly impact on competitive advantage within the South African SMEs in dynamic environments?

4. How do dynamic capabilities impact on ICT utilisations of South African SMEs in dynamic environments?

5a. What is the contingent effect of firm size and age on ICT utilisations?

5b. What is the contingent effect of firm size and age on the absorptive capability?

5c. What is the contingent effect of firm size and age on the innovative capability?

Using these questions, a conceptual framework (Figure 1) was created.

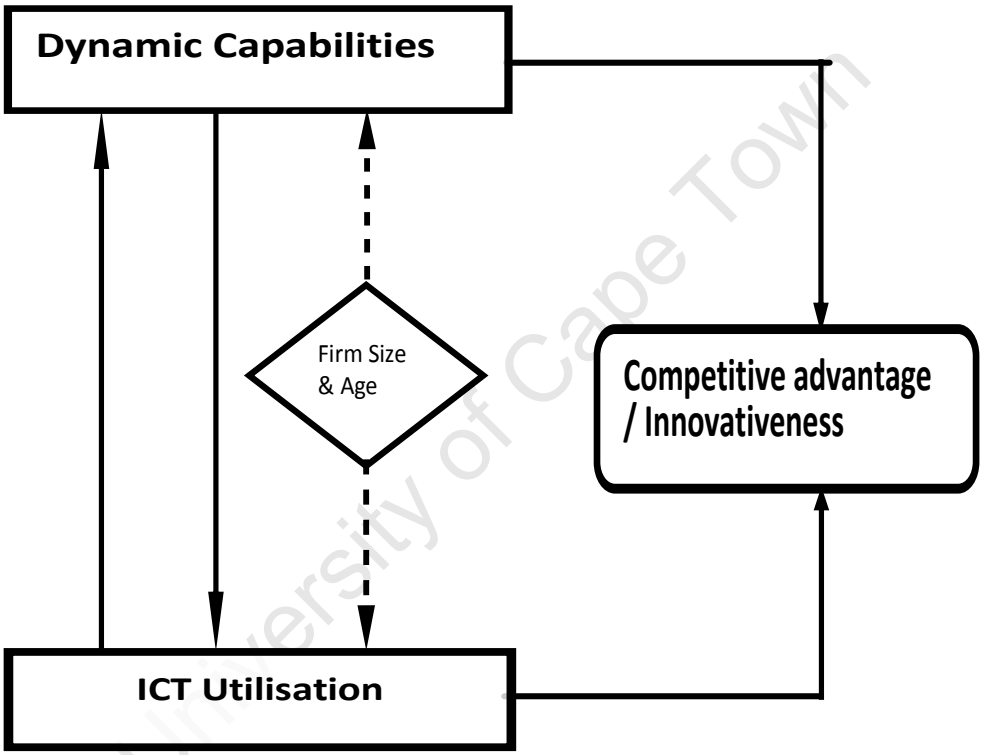

Figure 1: Conceptual Framework

1.4. Scope of study

This study focused on two main variables: DCs and ICT utilisation, both of which can provide SMEs with competitive advantage. The only source of competitive advantage used in this study is innovation, as it is deemed to be a major source of competitive advantage for SMEs (Crossan & Apaydin, 2009; Di Maria & Micelli, 2008; Terziovski, 2010). Other capabilities such as knowledge

management, geographical, operating, incremental, regenerative and renewing capabilities (Davenport & Short, 1990; Easterby-Smith *et al*., 2009; Newey & Zahra, 2009), and other sources of competitive advantage are beyond the scope of this study..

1.5. Overview of research methodology

This study begins with a conceptual and theoretical structure, and moves towards empirical evidence (deductive reasoning). The study is descriptive and exploratory, takes a positivist stance, as well as employing judgement sampling to identify and invite individuals responsible for Information Technology (IT) of South African SMEs. Sixty-five usable responses were obtained through an online based, semi-structured questionnaire and the study cut across all economic sectors. The data collection technique generated both quantitative and qualitative data; quantitative data was analysed using STATISTICA version 10 and WarpPlus version 2.0 while qualitative data was discussed accordingly.

1.6. Benefits of the study

This study provides an understanding of the variables that are relevant in explaining competitive advantage within the SMEs in a changing business environment. It gives an understanding of the purpose and level of ICT utilisation within the South African SMEs. The study contributes to the body of knowledge on DCs by:

- conceptualising DCs,
- extending the used four DCs to include sensing, integrative and behavioural capabilities, and
- providing empirical support for DC variables.

The study examines the significant impact of ICT utilisations and DCs on the competitive advantage of South African SMEs, and provides interesting cues for practice and for future research.

1.7. Limitations of the study

As with all research, this study has some limitations: This study was built on DC – an extension of the Resource-Based View, to investigate how South African SMEs use ICT and DCs to achieve competitive advantage, and the impacts of ICT utilisation and DCs on competitive advantage. Other theories such as the theory of competitive rationality, neo-classical perfect competition theory, Structure Conduct Performance (SCP) based theory, an evolutionary theory of competitive advantage (Barney, 2001a, 2001b; Hunt & Morgan, 1995), that might contribute significantly, were not considered. The scope of the study was limited to SMEs with less than 250 employees from South African Regional Chambers of Commerce, Proudly South African and some Business Park databases. This study used limited survey responses; a larger sample size could have increased the accuracy of the study.

1.8. Structure of the study

This study is organised as follows: Chapter 2 (literature review) offers the analysis of existing literature on SMEs, competitive advantage, ICT utilisation and DCs. It presents the research questions and research hypotheses that were developed from a conceptual framework.

Chapter 3 (research methodologies) discusses the research philosophy, research approach, research purpose, sampling strategies and data collection techniques employed to address the research questions.

Chapter 4 (data analysis and results) presents the descriptive statistics, Spearman rank order, correlations of constructs, reliability and validity tests, and characteristics of responses. It discusses the descriptive research questions and tests hypotheses to address exploratory research questions.

Chapter 5 (discussion and conclusion) summaries the study, discusses findings in light of the literature, and presents recommendations for practice and for future research.

2. Literature review

This chapter reviews relevant and recent literature selected from Google scholar, Science Direct, EBSCO host and MasterFile Premier databases. Keywords such as firm capabilities, competitive advantage, firm resources, ICT capabilities, ICT usage, innovation, SMEs were initially used to select the literature, and to identify concepts relating to how SMEs use ICT and DCs to achieve competitive advantage, as well as the impacts of ICT and DCs on competitive advantage. The following sections elaborate sequentially on SMEs, competitive advantage and innovativeness, ICT utilisation, and DCs.

2.1. Small and Medium Enterprises (SMEs)

In the Republic of South African National Small Business Amendment Act (2003), company size is based on the total full-time equivalent of paid employees, total turnover and total gross asset value (fixed property excluded). A small firm is classified as having up to 50 employees, approximately R13 million total turnover and approximately R5 million gross asset value. A medium firm is classified as having less than 250 employees, approximately R26 million total turnover and approximately R6 million gross asset value.

In 2008, research conducted in South Africa indicated that 53% of all the firms "have less than 100 employees" (Sawers *et al.*, 2008, p. 173); this implies that SMEs dominate South African economy. South African SMEs' "contribute 56% of private sector employment" (Fatoki & Smit, 2011, p. 1413). SMEs' contributions cannot be ignored – SMEs are significant in their contributions to economic growth, innovation of new products, technological progress and competitive advantage (Berry *et al.*, 2002; Frempong, 2007; Kotelnikov, 2007; Nieto & Fernandez, 2006).

However, most SMEs are confronted with challenges such as changes in technologies, changes in innovative products, changes in customer demands, and the desire to remain flexible (Abor & Quartey, 2010; Parida, 2008). SMEs are also characterised by having limited ICT capabilities, limited human and financial resources, and are often faced with competitive forces which threaten their survival (Cragg, Caldeira & Ward, 2006; Di Maria & Micelli, 2008; Eikebrokk & Olsen, 2007; Parida, Westerberg & Ylinenpaa, 2009; Pavic, Koh, Simpson & Padmore, 2007; Pillania, 2008). As the number of SMEs increases, competition increases, and in the face of globalisation, the question of how SMEs can achieve and maintain competitive advantage becomes a major concern to both managers and researchers (Rivard, Raymond & Verreault, 2006). It is essential for SMEs to develop inimitable capabilities that support business strategies, in order to achieve competitive advantage in fast changing business environments (Lindblom *et al.,* 2008).

2.2. Competitive advantage and innovativeness

Competitive advantage is a firm's ability to implement a market strategy that facilitates price reduction, productivity and ample utilisation of market opportunities (Newbert, 2008; Africa Competitiveness Report, 2009). Competitive advantage is the ability to create value (Africa Competitiveness Report, 2009), and "the degree to which a firm has reduced costs, exploited opportunities, and neutralised threats" (Newbert, 2008, p. 752). In other words, competitive advantage is a firm's ability to deploy valuable processes and resources, not implemented by the competitors, which can provide firms with opportunity over their competitors. A firm's resources (which are tangible and intangible assets, human assets and all other activities that enable firms to create values) and capabilities are the main sources of competitive advantage. Tangible assets are combined with intangible assets in other to achieve competitive advantage (Lindblom *et al.,* 2008; Perez & De Pablos, 2003).

However, gathering bundles of resources does not guarantee competitive advantage, because the resources that will provide competitive advantage cannot be bought, but must be gradually developed/built within a firm (Borch & Madsen, 2007). Resources alone cannot provide competitive advantage, but must be transformed into capabilities (Borch & Madsen, 2007). Therefore, SMEs must possess distinctive capabilities to compete in rapidly changing environments, which can be perceived from their ability to introduce new concepts, new processes, new strategies etc., as well as their ability to adapt to change. The type of change (which can be in process, product or service) and the degree of change (which can be radical or incremental) that occurs within a firm during a period reveals how innovative it is, hence the probability of acquiring competitive advantage (Tidd, Bessant & Pavitt, 2001).

SMEs need to continually grow by being highly innovative, in order to achieve and maintain competitive advantage (Cadiz, Sawyer & Griffith, 2009). Since innovation is the main source of competitive advantage for SMEs (Crossan & Apaydin, 2009; Dess & Picken, 2000; Donner, 2007; Kotelnikov, 2007; Terziovski, 2010; Wang & Ahmed, 2004), this study confines its view of competitive advantage to innovativeness of SMEs. There are five main constructs identified from research on a firm's innovativeness: process, market, strategic, product and behavioural innovativeness (Crossan & Apaydin, 2009; Wang & Ahmed, 2004).

Process innovativeness is the ability of a firm to introduce a new production method, new technology or new management approach (Crossan & Apaydin, 2009) e.g. Cisco introduced a new approach to production and management in their net readiness approach (Hartman & Sifonis, 2000).

Market innovativeness is a new approach introduced by a firm to exploit a niche market (Wang & Ahmed, 2004) e.g. as in the case of Amazon using the World Wide Web to market books (Friedman, 2006).

Strategic innovativeness is the ability of a firm to discover lapses in the established markets and develop valuable new competitive strategies (Wang & Ahmed, 2004; Winter, 2003) e.g. as in the case of Dell cutting out the middleman and selling directly to consumers (Friedman, 2006).

Product innovativeness is related to market innovativeness, but is associated with long-term business success (Wang & Ahmed, 2004), the extent to which a newly introduced product is perceived to be useful to customers (Wang & Ahmed, 2004) e.g. as in Apple's iPhone and iPad (Friedman, 2006). Innovative products are intentionally introduced to meet the needs of some customers, which were previously neglected.

Behavioural innovativeness has three different levels: individual innovativeness (the individual's willingness to change), team innovativeness (the adaptive ability of the team in response to change) and managerial innovativeness (management's commitment and willingness to new ways of doing things) (Crossan & Apaydin, 2009) e.g. as in Cisco management's innovation in putting all company documents, forms, procedures, policies, etc. on their intranet for staff (Hartman & Sifonis, 2000).

Therefore, from the literature the following research question was developed: ***What gives South African SMEs competitive advantage in dynamic environments?*** – Descriptive question 'a' (section 1.3). The next section presents ICT utilisation as one of the ways through which SMEs can gain competitive advantage.

2.3. ICT utilisation

ICT is one of the ways whereby SMEs can improve products and business processes in order to combat pressure from competitors (Kotelnikov, 2007). The "potential of information technology to provide firms with competitive advantage has been a topic of interest to practitioners and academicians" (Ravichandran & Lertwongsatien, 2005, p. 238). ICT is an essential tool for business processes and can assist SMEs to achieve competitive advantage (Hooper, Kew & Herrington, 2010; Rohrbeck, 2010), even in dynamic environments. According to Kew and Herrington (2009), ICT can contribute significantly to SMEs, while the effective use of ICT can positively impact on SMEs.

Studies have shown that ICT utilisation can be broken down into eight aspects (Hooper et al., 2010; Kew & Herrington, 2009; Konde, 2007; Matlay & Addis, 2003; Molla, 2005; Mutula & Van Brakel, 2006; Parida, 2008):

- Enable cost savings
- Establish business collaborations with new partners
- Maintain collaboration with existing business partners
- Handle collaboration within the firm
- Handle external communication with the firm's stakeholders
- Establish relationships with other organisations
- Handle business transactions
- Enable strategic planning.

Effective use of ICTs can improve productivity, reduce transaction costs and save business time (Konde, 2007; Mutula & Van Brakel, 2006). ICTs can serve as communication, collaboration and transaction tools for SMEs (Molla, 2005; Parida, 2008). ICT as a communication tool is the ability of a firm to use information and communication technologies and tools, to share business information

within the firm and to provide basic information about its products and services to customers (Molla, 2005; Parida, 2008). ICT as a collaboration tool is a firm's ability to handle inter-organisational relationships with business partners. ICT as a transaction tool is a firm's ability to allow "online selling and purchasing of products and services" (Molla, 2005, p. 5).

Kew and Herrington (2009, p. 24) indicate that SMEs with "limited usage of ICT could lose out on business opportunities". Studies have shown that ICT utilisation can enhance a firm's capabilities and can influence and facilitate innovation (Gago & Rubalcaba, 2007; Lin, 2007).

The questions that arose from the literature are: ***How are South African SMEs using ICT in dynamic environments?*** – Descriptive question 'b', ***How do ICT utilisations impact on the competitive advantage of South African SMEs in dynamic environments?*** – Exploratory research question 1, and ***How do ICT utilisations impact on dynamic capabilities of South African SMEs in dynamic environments?*** – Exploratory research question 2 (section 1.3).

From Kotelnikov's (2007) ICT adoption framework, the purpose and level of ICT utilisation varies from one industry to another. The next section presents the purposes and levels of ICT utilisation.

2.3.1. Purposes of ICT utilisation

A firm's ability to use ICT applications and functions includes mobile phones, fixed-line phones, the fax machine, e-mail, intranet, video conferencing, website, Voice over Internet Protocol (VoIP) etc. for business purposes (Matlay & Addis, 2003; Parida, 2008). Studies show that SMEs use ICT applications and functions for obtaining information, for storing information, for banking, for purchasing, for marketing, for communication with customers and suppliers, for finding partners locally and internationally and for new business opportunities (Gago & Rubalcaba, 2007; Kew & Herrington, 2009; Lin, 2007).

SMEs need to use ICT to obtain information on business trends, markets and business organisation (Chiware & Dick, 2008). Kew and Herrington (2009) found that, regardless of the size of the firm, South African SMEs primarily used internet for business research and for the following purposes: banking (47.3%), business research (85%), finding new business ideas (52.9%), finding new partners (24.9%) and promoting the business (46.3%), while 52.5% used the website for business purposes. ECLAC (2005) indicated that SMEs in Latin America and East Asia used the internet for obtaining information (90%), for banking (80%), for marketing (54%), for communicating with public authorities (53%), and for finding job opportunities (27%). However, Kotelnikov (2007, p. 5) noted that "not all SMEs need to use ICT to the same degree of complexity", and indicated that there are levels of ICT utilisation.

2.3.2. Levels of ICT utilisation

The levels of ICT utilisation range from basic communications capability, to basic information technology capability, to advanced communications capability and to advanced information technology capability (Kotelnikov, 2007).

Basic communication (BC) capability includes a firm's ability to use the fixed line/mobile phone for business purposes. SMEs need ICT to communicate with their suppliers and customers without the need to pay personal visits (Kotelnikov, 2007). Esselaar, Stork, Ndiwalana & Deen-Swarray (2006) found that the mobile phone is the most important communication tool for SMEs in thirteen African countries, namely South Africa, Nigeria, Ghana, Uganda, Namibia, Kenya, Ethiopia, Cameroon, Mozambique, Tanzania, Rwanda, Botswana and Zimbabwe. Esselaar *et al.*, (2006) showed that 70% of SMEs used mobile phones to maintain relationships with customers, while 48% used fixed-line telephones. In other words, ICT serves as the basic communication tool for most SMEs.

Basic communication tools such as fax machines, mobile phones and fixed-lines do not require face-to-face meetings (Kew & Herrington, 2009), therefore they save time and improve business transactions (Kotelnikov, 2007). BC capability may create intimacy between SMEs and their customers. Consequently, SMEs can be prompt in their response to the shift in customers' needs and tastes (Ravichandran & Lertwongsatien, 2005).

After SMEs have acquired BC capability, they move on to Basic Information Technology (BIT) capability level – acquiring a PC with basic software, which can be proprietary and/or free and open-source software such as word processing, spread sheets, presentation graphics, accounting packages (Kotelnikov, 2007). BIT capability includes a firm's ability to use a Personal Computer (PC) with basic software connected to a printer (Kotelnikov, 2007). Mutula and Van Brakel (2006) found that 69% of South African SMEs had three or more PCs, 11% had no PC, and, of those that had PCs, 87% did not use the internet for business transactions.

Advanced Communication (AC) capability includes the ability of SMEs to make use of the internet and/or the intranet as a communication tool (Kotelnikov, 2007). The availability of the internet, an effective tool for marketing (Modimogale & Kroeze, 2007), may enhance the relationship between SMEs and their customers, as SMEs are able to use advanced tools such as video conferencing, VoIP, AutoCAD and email. A study conducted in Canada, for example, revealed that the majority of SMEs in the Agriculture sector used e-mail for communication purposes and approximately 85% used internet facilities (Mutula & Van Brakel, 2006). The evolution of new generation mobile phones has enabled a number of SMEs to have access to the internet without possessing a PC (Kew & Herrington, 2009). AC capability may improve business processes and reduce the costs of production (Kotelnikov, 2007).

Advanced Information Technology (AIT) capability includes the ability of SMEs to use a PC with advanced software (such as Customer Relation Management (CRM), payroll, human resources, databases, inventory management and Enterprise Resource Planning (ERP) applications), to extract value from information (Kotelnikov, 2007). Information is needed for effective business transactions (Mutula & Van Brakel, 2006). SMEs need high-quality, advanced systems and AIT capabilities to effectively benefit from business information (Mutula & Van Brakel, 2006). SMEs need timely, relevant and current information to compete in dynamic environments (Mutula & Van Brakel, 2006).

Kotelnikov (2007) noted that the level of ICT utilisation is sector specific, and that Manufacturing firms are likely to use more AIT. Research conducted in North America showed that 69% of SMEs used websites, and 31% used credit card payment for business to business transactions (Mutula & Van Brakel, 2006). However, SMEs in Botswana struggled to gain access to relevant information needed to improve business transactions and had an adverse effect on their performances (Mutula & Van Brakel, 2006).

A study conducted on small firms' competitiveness in Sweden found that, while firm age has no effect on ICT utilisation, firm size does (Parida *et al.,* 2009). More studies are required to understand the effect of firm size and age on ICT utilisation and ICT capabilities. The questions that emerged from the literature review are: ***What is the contingent effect of firm size and age on the ICT capabilities?*** – Descriptive question 'c', and ***What is the contingent effect of firm size and age on the ICT utilisation?*** – Exploratory research question 5a (section 1.3).

Regardless of firm size and age, SMEs need to effectively use ICT and develop strong ICT capabilities to innovate and adapt to changing environment (Kotelnikov, 2007; Lindblom *et al.*,

2008), and need to transform resources to DCs to achieve competitive advantage (Borch & Madsen, 2007; Lindblom *et al.*, 2008).

2.4. Resource-Based View and Dynamic Capabilities

Resource-Based View (RBV) is a strategic management approach and a significant theoretical approach to understand how firms achieve and maintain competitive advantage (Kraaijenbrink, Spender & Groen, 2010; Lockett, Thompson & Morgenstern, 2009; Sawers *et al.*, 2008). RBV emphasises a firm's heterogeneous resources, which may be tangible or intangible. Resource based theorists agree that firms possess accumulated heterogeneous resources and are equally concerned with how firms achieve competitive advantage (Ambrosini & Bowman, 2009; Denrell, Fang & Winter, 2003; Zhou & Li, 2010).

Dynamic Capability (DC) is an extension of RBV and hence shares similar assumptions (Ambrosini & Bowman, 2009; Newbert, 2008; Schreyogg & Kliesch-Eberl, 2007). DCs are organisational processes purposefully designed to alter the "firm's resource base" (which are resources that can enable a firm to accomplish its aims), in order to achieve competitive advantage in rapidly changing business environments (Helfat *et al., 2007*). DC is a set of capabilities that enable a firm to respond quickly to new opportunities, and DC is concerned with how to rejuvenate and integrate a firm' resources (Schilling, 2006; Zhou & Li, 2010). DC involves repeated processes that influence a "firm's resource base" and hence governs firm's VRIN (Valuable, Rare, Inimitable and Non-substitutable) resources (Ambrosini & Bowman, 2009; Helfat *et al.*, 2007).

Valuable resources are operational capabilities, superior capabilities or substantive capabilities (Lindblom *et al.*, 2008; Winter, 2003; Zahra *et al.*, 2006) which allow firms to meet current needs or immediate demands that can improve the effectiveness of the firm (Ambrosini & Bowman, 2009;

Perez & De Pablos, 2003). Valuable resources provide firms with the required flexibility to respond to environmental opportunities and pressures. Rareness indicates that the resources are scarce and are not possessed by the competitors. Inimitable implies that the resources cannot be easily duplicated or copied by rivals, examples being scientific discovery, brand name, etc. Non-substitutable means that the resources are not easily replaced or substituted (Newbert, 2008; Perez & De Pablos, 2003; Ren, Xie & Krabbendam, 2010; Sirmon, Hitt & Ireland, 2007; Terziovski, 2010).

Like RBV, DC focuses on a firm performance and competencies; although DC's emphasis is on dynamics: i.e. change (Easterby-Smith *et al.,* 2009). However, only the DC perspective outrightly examines how firms can create and sustain competitive advantage in fast changing environments (Ambrosini & Bowman, 2009). More importantly, DCs enable firms to generate and maintain long-term returns in a fast changing environment (Ambrosini & Bowman, 2009; Helfat *et al.*, 2007). The role of DC is to influence a firm's existing resource base, such that new VRIN resources are created to achieve competitive advantage (Ambrosini & Bowman, 2009).

To achieve competitive advantage, SMEs need to take advantage of VRIN resources and external environmental changes (Ambrosini & Bowman, 2009). DC includes a firm's ability to sense and capitalise on new market opportunities (Wilden, Gudergan & Lings, 2009). While in a competitive environment, firms need to develop DCs to survive (Zhou & Li, 2010), SMEs need to develop more intense capabilities than large firms, in order to overcome the liability of smallness and to outperform competitors (Borch & Madsen, 2007; Terziovski, 2010).

DC has been conceptualised as a firm's capacity to sense, create, extend, modify, reconfigure, integrate, renew, etc. its ordinary or core capabilities, in order to achieve and maintain competitive advantage in fast changing environments (Ambrosini & Bowman, 2009; Augier & Teece, 2008;

Borch & Madsen, 2007; Eisenhardt & Martin, 2000; Helfat *et al.*, 2007; Liao, Kickul & Ma, 2009; McKelvie & Davidsson, 2009; Narayanan *et al.*, 2009; Newey & Zahra, 2009; Teece, 2007; Wang & Ahmed, 2007; Winter, 2003; Zahra *et al.*, 2006; Zhou & Li, 2010; Zollo & Winter, 2002).

Many studies focused on the definition and nature of DC (McKelvie & Davidsson, 2009; Teece, 2007; Winter, 2003), while others examined the effects and consequences of the DC on firms' performances and competitive advantages (Augier & Teece, 2008; Easterby-Smith *et al.*, 2009). Based on ten years of review, Wang and Ahmed (2007) identified three DCs constructs (absorptive capability, adaptive capability and innovative capability) as the core components of DC. Parida (2008) suggested that networking capability should be part of DC constructs. Two other DC constructs, namely sensing and integrative capabilities, were found in the literature (Jusoh & Parnell, 2008; Lindblom *et al.*, 2008; Morgan, Slotegraaf & Vorhies, 2009).

The six major DC constructs – sensing, absorptive, adaptive, innovative, networking and integrative capabilities – found in the literature (Jusoh & Parnell, 2008; Lindblom *et al.*, 2008; Morgan *et al.*, 2009; Parida, 2008; Wang & Ahmed, 2007), are discussed sequentially.

2.4.1. Sensing capability

Sensing capability, one of the main sources of competitive advantage, is the ability of the firm to learn promptly about competitors, customers and the business environments (Lindblom *et al.*, 2008; Morgan et al., 2009), ahead of its rivals. Consequently, firms with sensing capability demonstrate anticipatory skills, making it possible to understand customers' demands ahead of competitors (Morgan *et al.*, 2009). Sensing capability is fundamentally the ability of a firm to use market intelligence and be cognisant or aware of market change, so as to predict more accurately customers' responses to change (Lindblom *et al.*, 2008). In other words, sensing capability can enable SMEs to

gather valuable market information and interpret the information to gain competitive advantage and superior performance (Lindblom *et al.*, 2008).

2.4.2. Absorptive capability

Ideally, after firms have acquired sensing capability, they move on to acquire absorptive capability. Absorptive capability is located within the fields of DC, organisational learning and knowledge management (Easterby-Smith, Graca, Antonacopoulou & Ferdinand, 2008), and hence is a firm's ability or capacity to recognise (i.e. know the value), develop and utilise external knowledge to create valuable new knowledge (Lane, Koka & Pathak, 2006; Wang & Ahmed, 2007; Zhou & Li, 2010). Significantly, in dynamic environments, absorptive capability is a source of competitive advantage once the new/acquired knowledge is transformed into usable knowledge (Cadiz *et al.*, 2009; Zhou & Li, 2010). Thus, firms with high level of absorptive capability are highly innovative, as the capability complements and reinforces the "firm's resource base" to accurately predict future technological developments (Lane *et al.*, 2006; Wang & Ahmed, 2007; Zhou & Li, 2010). Absorptive capability can help SMEs to advance in technological fields and outperform competitors (Wetter & Delmar, 2007).

In addition, absorptive capability involves application of environmental knowledge, acquired through organisational learning processes, to improve business strategies (Lane *et al.*, 2006). Exploiting and retaining absorptive capability is essential for long-term survival of SMEs (Lane *et al.*, 2006). Sourcing both external and internal knowledge is crucial to developing absorptive capability (Volberda, Foss & Lyles, 2009). Wetter and Delmar (2007) note that firm size and age have an impact on the absorptive capability of newly established firms. So the question that comes to mind is: ***What is the contingent effect of firm size and age on the absorptive capability of South African SMEs?*** – Exploratory research question 5b (section 1.3).

2.4.3. Adaptive capability

After absorptive capability, firms need to possess adaptive capability. Zhou and Li (2010) view adaptive capability as a key element of DC. Adaptive capability is the firm's ability to quickly reconfigure and coordinate its resources in response to rapid environmental changes (Gibson & Birkinshaw, 2004; Sapienza, Autio, George & Zahra, 2006; Zhou & Li, 2010). In other words, adaptive capability is the ability of a firm to respond to external changes ahead of competitors, through reconfiguration of its internal resources and processes (Zhou & Li, 2010). In a DC perspective, competitive advantage is obtained through continuous development and reconfiguration of valuable assets (Augier & Teece, 2008; Teece, 2007).

2.4.4. Innovative capability

Adaptive capability should enhance the innovative capability of firms. Innovation is a significant source of competitive advantage in changing or dynamic business environments; it is basically a new way of doing things: "a new good or a new quality of good; a new method of production; a new market; a new source of supply; or a new organisational structure" (Crossan & Apaydin, 2009, p. 2; Dess & Picken, 2000). A firm's success and survival depends largely on the firm's ability to create value or innovate (Wang & Ahmed, 2004). Firms with high innovative capability outperform competitors, and "demonstrate higher profitability, greater market value, superior credit ratings, and higher survival probabilities" because competitive advantage increases with innovation (Volberda *et al.*, 2009, p. 1). As a result, innovation capability determines a firm's performance in dynamic conditions (Crossan & Apaydin, 2009).

It is highly imperative for SMEs to advance in innovative capability by capitalising on knowledge from external sources (Borch & Madsen, 2007; Volberda *et al.*, 2009). Innovation of new processes and products originates from a combination of newly acquired knowledge, renewal of organisational strategies and processes to achieve competitive advantage (Augier & Teece, 2008). Competitive

advantage depends on a firm's ability to effectively develop internal knowledge and exploit external knowledge in order to improve on the innovative capability of the firm (Fabrizio, 2009).

However, a report on the South African innovative survey suggests that medium size firms are likely to be more innovative than small firms, and that "innovation is a matter of size" (Oerlemans, Pretorius, Buys & Rooks, 2003, p. 47). From this, the following question was developed: ***What is the contingent effect of firm size and age on the innovative capability of South African SMEs?*** – Exploratory research question 5c (section 1.3).

2.4.5. Networking capability

Networking capability is the ability of a firm to create and utilise inter-organisational relationships to acquire various resources (Walter, Auer & Ritter, 2006). It is a firm's ability to be strategically positioned in the network and thus establish beneficial relationships with chosen partners (Hagedoorn, Roijakkers & Kranenburg, 2006). SMEs must be able to use inter-organisational relationships to improve business performance and acquire competitive advantage in fast changing business environments (Walter *et al.*, 2006).

To achieve and sustain competitive advantage, SMEs can collaborate with suppliers and certain competitors to build a powerful network. Therefore, inter-organisation collaboration can assist SMEs to be highly innovative, as it exposes firms to new technologies and new business strategies (Sawers *et al.*, 2008).

2.4.6. Integrative Capability

Integrative capability is the firm's ability to combine all the resources and competencies acquired from sensing, adoptive, adaptive, networking and innovative capabilities, and to harmonise them to generate competitive advantage in fast changing business conditions. Integrative capability enhances a firm's performance (Jusoh & Parnell, 2008), and it involves the alignment of external knowledge

with internal knowledge to meet the goals and objectives of the firm. SMEs with integrative capability should be able to harmonise both internal resources and capabilities (internal integration) with external resources and capabilities (external integration), to create values in dynamic conditions.

In addition, integrative capability is the ability of the firm to effectively manage internal and external changes. SMEs with integrative capability can synchronise past experiences with inimitable capabilities (resources and competencies), then exploit them within the firm, without causing havoc to the firm. Firms with integrative capability are high-risk takers and thus embrace new technologies easily. In other words, SMEs with integrative capability possess high innovative capability leading to competitive advantage.

It is necessary, therefore, to understand the types of DCs that can significantly impact on SMEs' competitive advantage, as Ambrosini and Bowman (2009, p. 36) argued that sensing capability is not DC, but is "managerial and organisational processes that underpin and enable the deployment of dynamic capabilities". So the questions that arose from the literature review are: ***What types of DCs will significantly impact on competitive advantage within the South African SMEs in dynamic environments?*** – Exploratory research question 3, and ***How do DCs impact on ICT utilisations of South African SMEs in dynamic environments?*** – Exploratory research question 4 (section 1.3).

In attempts to answer all the exploratory research questions highlighted in this study, hypotheses were developed and are presented in the next section.

2.5. Development of hypotheses

This section presents the hypotheses that were developed to answer the exploratory research questions, which were highlighted in section 1.3. The study has two independent variables: ICT utilisation and DCs; as well as one dependent variable: competitive advantage. This study explores causal relationships (a causal relationship indicates that one variable causes a movement in another variable) (Cavana, Delahaye & Sekaran, 2001). The causal relationships explored are between:

- ICT utilisation and competitive advantage,
- ICT utilisation and DCs,
- DCs and ICT utilisation,
- DCs and competitive advantage and
- Firm size and age on ICT utilisation, absorptive capability and innovative capabilities (see Figure 2: Research Measurement Framework).

There is a need to characterise the level of SMEs' ICT sophistication to determine the impact of ICT utilisation on competitive advantage and DCs, and how SMEs use ICT and DCs to achieve competitive advantage (Fang *et al.*, 2008).

From the literature, ICT utilisation can be sorted into eight categories: cost saving, establish collaboration, maintain collaboration, hand collaboration, handle communication, establish relationship, hand transaction and strategic planning (Hooper *et al.*, 2010; Kew & Herrington, 2009; Konde, 2007; Matlay & Addis, 2003; Molla, 2005; Mutula & Van Brakel, 2006; Parida, 2008).

In the same way, since innovativeness is considered to be the major source of competitive advantage for SMEs (Crossan & Apaydin, 2009; Dess & Picken, 2000; Wang & Ahmed, 2004), this study

adopted Wang and Ahmed's (2004) five organisational innovativeness constructs, namely: process, market, strategic, product and behavioural innovativeness, to measure competitive advantage.

DCs have six constructs, namely: sensing capability, absorptive capability, adaptive capability, innovative capability, networking capability and integrative capability (Jusoh & Parnell, 2008; Lindblom *et al.*, 2008; Morgan *et al.*, 2009; Parida, 2008; Wang & Ahmed, 2007).

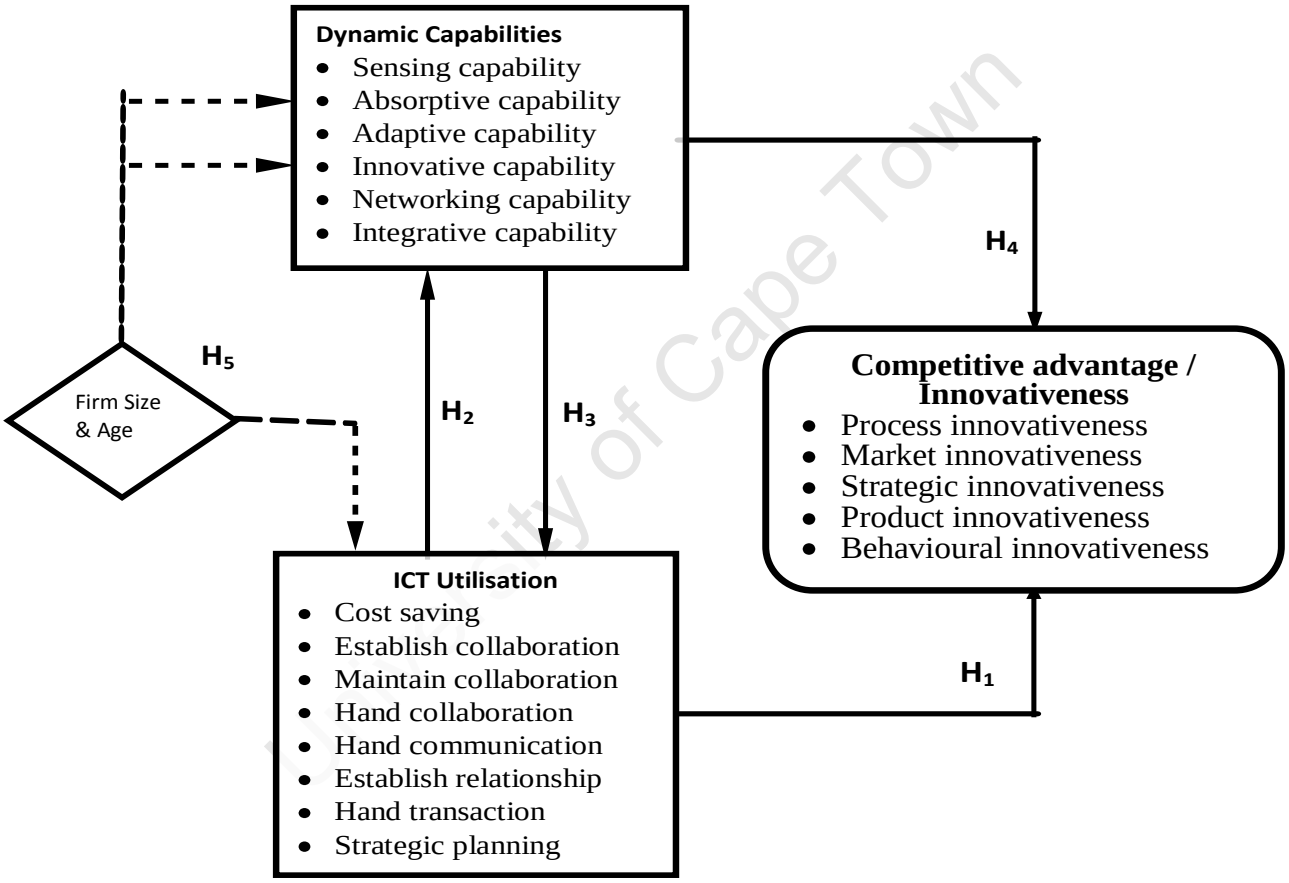

Figure 2: Research Measurement Framework

Therefore, in order to answer the exploratory research questions in section 1.3, the impacts of ICT utilisation on competitive advantage, ICT utilisation on DCs, DCs on ICT utilisation, DCs on competitive advantage, and the contingent effects of firm size and age on ICT utilisation, absorptive and innovative capabilities, are subsequently hypothesised as follows:

2.5.1. Impact of ICT utilisation on competitive advantage

H_1: *ICT utilisation will have significant impact on competitive advantage.*

2.5.2. Impact of ICT utilisation on DCs

H_2: *ICT utilisation will have significant impact on DCs.*

2.5.3. Impact of DCs on competitive advantage

H_3: *All DCs will have significant impact on competitive advantage.*

2.5.4. Impact of DCs on ICT utilisation

H_4: *DCs will have significant impact on ICT utilisation.*

2.5.5. Contingent effects of firm size and age on ICT utilisation, absorptive and innovative capabilities

H_{5A}: *Firm size and age will have significant impact on ICT utilisation.*

H_{5B}: *Firm size and age will have significant impact on absorptive capability.*

H_{5C}: *Firm size and age will have significant impact on innovative capability.*

The next section describes the research methodologies adopted to test the research hypotheses and address the research questions.

3. Research methodologies

This chapter discusses the philosophical assumptions which underpin this research (ontology and epistemology, methodology and research purpose). Section 3.1 (Research philosophy) presents the research philosophy, research approach and research purpose. Section 3.2 (Sampling strategies) presents the sampling technique used to select the participants for data collection. Section 3.3 (Data collection technique) presents the data collection technique employed to address the research questions. Section 3.4 (Research ethics) presents the required ethics approval process that the study went through before commencing the data collection. Section 3.5 (Method of data analysis) presents an overview of data analysis techniques that the study employed.

3.1. Research philosophy

It is deemed necessary to understand the philosophy that underpins research, because research is a complex process; however researchers have different beliefs about how to conduct research (Cavana, Delahaye & Sekaran, 2001). This includes beliefs about physical and social reality (ontological beliefs), beliefs about knowledge (epistemological beliefs) and beliefs about the relationship between knowledge and the empirical world (relationship between theory and practice – research methodology) (Orlikowski & Baroudi, 1991). This section discusses the ontological beliefs, the epistemological beliefs and the methodology adopted to address the research questions.

3.1.1. Ontology and epistemology

This study is based on the assumption that the world can be studied independently of the researchers (Cavana *et al.*, 2001), and the study takes a positivist ontological view. Ontology is concerned with the question of the existence of the real world (Niehaves, 2007). Ontology is "a particular system of categories accounting for a certain vision of the world" (Guarino, 1998, p. 4), and the study of reality or existence (Stahl, 2008).

This study takes a positivist epistemological stance to ensure objectivity during data collection and data analysis. Epistemology is concerned with the relationship between the object of knowledge and the acquired knowledge; it deals with the question of how humans can achieve true knowledge (Niehaves, 2007). The choice of the research methodology (positivist) is based on the type of the research questions and the assumption that the world is objectively constructed (Cavana *et al.*, 2001).

Three major epistemological studies, positivist, interpretive and critical studies, were reviewed. Positivist research was considered to be the most appropriate for this study, because positivist studies are based on the existence of relationships within phenomena which are mainly for testing hypotheses to increase the understanding of the phenomena (Orlikowski & Baroudi, 1991). Positivist research is based on precise and objective measures to identify universal laws which can be used to predict human activities (Cavana *et al.*, 2001). Positivist research uses deductive reasoning; deductive research begins with a conceptual and theoretical structure and moves towards empirical evidence (Cavana *et al.*, 2001; Welman, Kruger & Mitchell, 2005). This study follows a deductive reasoning, because DCs studies are conceptual and require empirical studies – the study begins with theoretical proposition and moves towards empirical evidences.

However, alternative studies are interpretive and critical (Cavana *et al.*, 2001; Orlikowski & Baroudi, 1991). An interpretive study will attempt to understand phenomena through the meaning people assign to them, while assuming that everyone shares the same meaning systems (Cavana *et al.*, 2001; Orlikowski & Baroudi, 1991). The interpretive researcher is concerned with understanding the lived experience of human beings, and identifies what is important to each individual or group of individuals (Cavana *et al.*, 2001). The interpretive researcher believes that reality and the individual who creates it cannot be separated and uses inductive reasoning; interpretive research begins with detailed observation of the world and moves towards theoretical generalisations (Cavana *et al.*, 2001;

Welman *et al.*, 2005). Interpretive research is based on subjective measures and assumes that reality is what people perceive it to be – reality is socially constructed, and people experience social and physical reality differently (Cavana *et al.*, 2001). Therefore, an interpretive study was considered inappropriate for this study, because this study required people to think objectively and aimed at testing theoretical concepts that were developed.

A critical study will attempt to critique or critically evaluate existing social systems to reveal any contradictions that may exist within their structures (Orlikowski & Baroudi, 1991). The critical researcher believes that social reality is historically constituted (Orlikowski & Baroudi, 1991) and assumes that "people have a great deal of unrealised potential and have the ability to adapt and transform themselves" (Cavana *et al.*, 2001, p. 10). Critical research aims to uncover surface illusions and empowers people to create a better world for themselves (Cavana *et al.*, 2001). Therefore, a critical study was considered inappropriate for this study, because this study is aimed at testing hypotheses and not at evaluating social systems.

3.1.2. Research Methodology

Research methods are broadly categorised into quantitative and qualitative methods (Cavana *et al.*, 2001). A quantitative research method was considered appropriate for this study since the measures (theoretical concepts) are well developed, the study aimed at testing hypotheses and positivist research usually involves quantitative data (Cavana *et al.*, 2001). A quantitative researcher aims to identify the expected solution to a problem or challenge by attempting to prove the research hypothesis (Cavana *et al.*, 2001). Quantitative research is largely based on deductive reasoning and causal relationships (Cavana *et al.*, 2001). Quantitative method will enable the research to remain objective (a quantitative researcher believes in the objectivity of reality), and provide a definitive answer based on exact measures, statistical analysis and verifiable truths (Cavana *et al.*, 2001).

Techniques of a quantitative data collection include questionnaires, field work and laboratory experimentations.

However, the alternative method is qualitative, but was considered inappropriate for this study, because a qualitative researcher believes that reality is subjective and that humans are complex. Qualitative research is based on inductive reasoning (starting from observation of the world and moving towards theoretical generalisations) which can be causal or non-causal; it "emphasises how participants experience and explain their own world" (Cavana *et al.*, 2001, p. 34). A qualitative research method will not be able to address the objectives of this study (hypothesis testing).

3.1.3. Research purpose

This study is both descriptive and exploratory in nature. The study was considered descriptive, because the study also aims to describe what gives South African SMEs competitive advantage in dynamic environments, how South African SMEs use ICT in dynamic environments and the contingent effects of firm size and age on the ICT capabilities of South African SMEs. As the name implies, a descriptive research describes a phenomenon as it appears; it can be used to obtain the characteristics information of the phenomenon under study (Collis & Hussey, 2007). A descriptive research explains a situation or looks for trends within a representative sample of a group that can be further generalised (Pickard, 2007).

The study was considered exploratory because very little empirical study has been done on DCs. Exploratory research investigates a phenomenon where there are few studies to discover patterns, concepts, ideas or hypotheses. An exploratory researcher focuses on gaining insights into and familiarity with the phenomenon under study (Collis & Hussey, 2007). This study aims at exploring how South African SMEs use ICT and DCs to achieve competitive advantage in dynamic environments, as well

as the impacts of ICT utilisation on DCs and on competitive advantage. An exploratory study provides a better understanding of the phenomena under study, and it is important for hypothesis testing (Cavana *et al.*, 2001).

However, other research purposes are explanatory and predictive: explanatory research explains why a problem or issue is happening, while aiming to understand a phenomenon under study. Predictive research goes further than explanatory research by predicting a similar situation occurring elsewhere (Collis & Hussey, 2007). This study did not aim to explain why a problem or issue was happening, or to predicting a situation, therefore this study cannot be considered an explanatory or a predictive research.

3.1.4. Research strategy: Survey

This study was intended to cut across all economic sectors and involved a large and geographically dispersed community. A survey was considered appropriate for the study, since it is not possible to get the entire population (all SMEs in South Africa) to participate in a research study (Cavana *et al.*, 2001). A survey research has three advantages – versatility, efficiency and generalisability – a research in which information is collected form a sample of individuals (Chambliss & Schutt, 2010).

3.2. Sampling strategies

It is believed that individuals responsible for IT are in the best position to provide the information on how SMEs use ICT for business purposes (Parida, 2008). Based on the experiences and involvement in business practices, an individual responsible for IT in SMEs has the knowledge required to provide a view on the research topic. Individuals responsible for IT in South African SMEs were considered appropriate and were selected for this study. Since this study focused on experts or people with the requisite information in the choice of subjects, judgement sampling – a type of purposive

sampling – was considered appropriate as the selection strategy (Cavana *et al.*, 2001). This study used judgement sampling to identify and invite respondents to participate in the study.

3.3. Data Collection

This study involved a large and geographically dispersed community. Because the researcher knew exactly what to measure, a questionnaire was considered appropriate for the data collection (Cavana *et al.*, 2001). The questionnaire enabled the researcher to reach a large sample at relatively low cost (Pickard, 2007). Survey data are often obtained by using questionnaires – a popular data collection tool in research that involves human subjects (Pickard, 2007). An attempt was made to get the initial contacts of South African SMEs via Regional Chambers of Commerce, Proudly South African and some Business Parks.

An online based, semi-structured questionnaire was considered appropriate for collecting the data, since the study is related to how ICT is used within the SMEs and it was assumed that respondents should at least possess basic ICT. A semi-structured questionnaire was used to allow respondents to make additional comments and increase the quality of the study.

3.3.1. Questionnaire design and piloting

The questions in the questionnaire were mostly adapted from previous studies (Parida, 2008; Kew & Herrington, 2009). However, to obtain content and construct validity of the measure (the questionnaire), a questionnaire of three pages, comprised of demographic questions, ICT utilisation questions, DCs questions and competitive advantage questions, was piloted on three professors within the Faculty of Commerce at the University of Cape Town and four Information Systems Masters' students. The questionnaire was also tested on three individuals responsible for IT at South African SMEs. The initial ten respondents were asked to provide the following information (Bell, 2010, p. 151):

- How long did it take you to complete?
- Were the instructions clear?
- Were any of the questions unclear or ambiguous? If so, will you say which and why?
- Did you object to answering any of the questions?
- In your opinion, has any major topic been omitted?
- Was the layout of the questionnaire clear/attractive?
- Any comments?

The questionnaire was adjusted based on the comments received from the pilot study, before creating an online based questionnaire (see Appendix A) which was used for collecting the data. The questionnaire was comprised of an introductory letter, which explained the motive and the need for the study. The online based questionnaire was designed to determine business profile, ICT utilisation, DCs and competitive advantage as indicated in the literature (Table 1).

From Table 1, it can be deduced how the research hypotheses were developed. For example, Hypothesis 1 (H_1) states that ICT utilisation will have significant impacts on competitive advantage,

H_2 states that ICT utilisation will have significant impacts on DCs,

H_3 states that DCs will have significant impacts on competitive advantage,

H_4 states that DCs will have significant impacts on ICT utilisation and

H_5 states that business profile (firm size and age) will have significant impacts on ICT utilisation and DCs (absorptive and innovative capabilities).

Concept	Description	Question
Business profile	the location of the business (based on province)	Q1
	age of business operation (based on years of establishment)	Q2
	type of industry	Q3
	size of the organisation (based on number of employees)	Q8
ICT **Utilisation**	basic communications (BC) capability basic information technology (BIT) capability advanced communications (AC) capability advanced information technology (AIT) capability	Q4, Q5, Q6
	obtaining information, store information, banking, purchasing, marketing, communication with customers and suppliers, finding partners locally and internationally, and new business opportunities	
	cost savings, establish collaboration, maintain collaboration, handle collaboration, handle external communication, establish relationship, handle transaction and strategic planning	
Dynamic capabilities (DCs)	sensing capability	Q9, Q10
	absorptive capability	
	adaptive capability	
	innovative capability	
	networking capability	
	integrative capability	
Competitive advantage	process innovativeness	Q7, Q11
	market innovativeness	
	strategic innovativeness	
	product innovativeness	
	behavioural innovativeness	

Table 1: Questionnaire composition

3.4. Research ethics

This study posed no physical or psychological risks to the participants. However, to maintain a high level of professionalism, the researcher complied strictly with the research ethics set by the Information Systems Department of the University of Cape Town (UCT). The research instrument

and the research proposal were subjected to the standard UCT ethics approval process. The information or data obtained in the course of the research was kept confidential. Participation was voluntary. A copy of the ethics form is attached (see Appendix B).

3.5. Method of data analysis

The data collection techniques (the semi-structured questionnaire) yielded both quantitative and qualitative data; they were analysed using both quantitative and qualitative data analysis techniques.

3.5.1. Quantitative data analysis technique

The quantitative data were analysed using STATISTICA version 10 and WarpPLS version 2.0. With the STATISTICA software package, Spearman rank order correlations were obtained to identify the relationships between the constructs, Cronbach Alpha values were measured to check for reliability of the constructs or measures and Factor analysis was carried out to group constructs into variables. With WarpPLS software package, Partial Least Square approach to Structural Equation Modelling was performed to test the research hypotheses.

3.5.2. Qualitative data analysis technique

The purpose of qualitative data is to understand the phenomena under study and to identify contents (themes and sub-themes in the raw data) (Cavana *et al.*, 2001). From the raw data, relevant and important information related to the study (descriptive research questions) was identified and categorised accordingly.

The next chapter (data analysis and results) presents detailed results of the data analysis.

4. Data analysis and results

This chapter is organised as follows: Section 4.1 presents the response rate. Section 4.2 describes the characteristics of the sample. Section 4.3 presents the Spearman rank order correlation of the sample, and reliability and validity tests using the STATISTICA software package. Section 4.4 discusses the descriptive research questions using the qualitative data. Section 4.5 presents the research hypotheses tests using the WarpPLS software package, then discusses the exploratory research questions.

4.1. Response rate

The online survey link was sent to 564 SMEs (these were initial contacts that were gathered via Regional Chambers of Commerce, Proudly South African and some Business Parks) from the nine provinces in South Africa, requesting responses from individuals responsible for IT. There were 62 mails that bounced back and could not be delivered. Nine SMEs indicated that they outsourced IT ("*We outsource our IT between 3 different companies*", *"Our IT is outsourced by a company*", etc.) and took no further part in the research process. Five companies indicated they were not within the scope ("*I don't think we qualify as an SME", "We have 700 employees", "We are not within scope*", etc.), and seven emails were received from SMEs, stating their inability to participate in the research. In order to improve the response rate, email reminders were sent to the respondents at intervals. A total of 79 questionnaires out of 481 (16.4% response rate) were returned, of which 14 were partially completed and could not be used for the data analysis. A total of 65 usable questionnaires were used for the data analysis.

A very low response rate is usually associated with research involving SMEs. With the intention of describing SMEs and their use of IT, Rasmussen and Thimm (2009) got a response rate of 12.6%. SMEs are known to "produce unsatisfying response rates" (Rasmussen & Thimm, 2009, p. 85). Wong and Aspinwall (2005) received a response rate of 8.7% and 18% from two sample groups, while studying the success factors for adopting knowledge management in SMEs.

The next section describes the characteristics of the sample used for data analysis.

4.2. Characteristics of the sample

4.2.1. Company location

The majority of SMEs in South Africa are located in the Gauteng province (Rogerson, 2000). Perhaps, due to the awareness of the University of Cape Town (UCT) in the Western Cape, 49% of the SMEs in the sample were located in the Western Cape province, with 38% located in Gauteng. The details are shown in Figure 3.

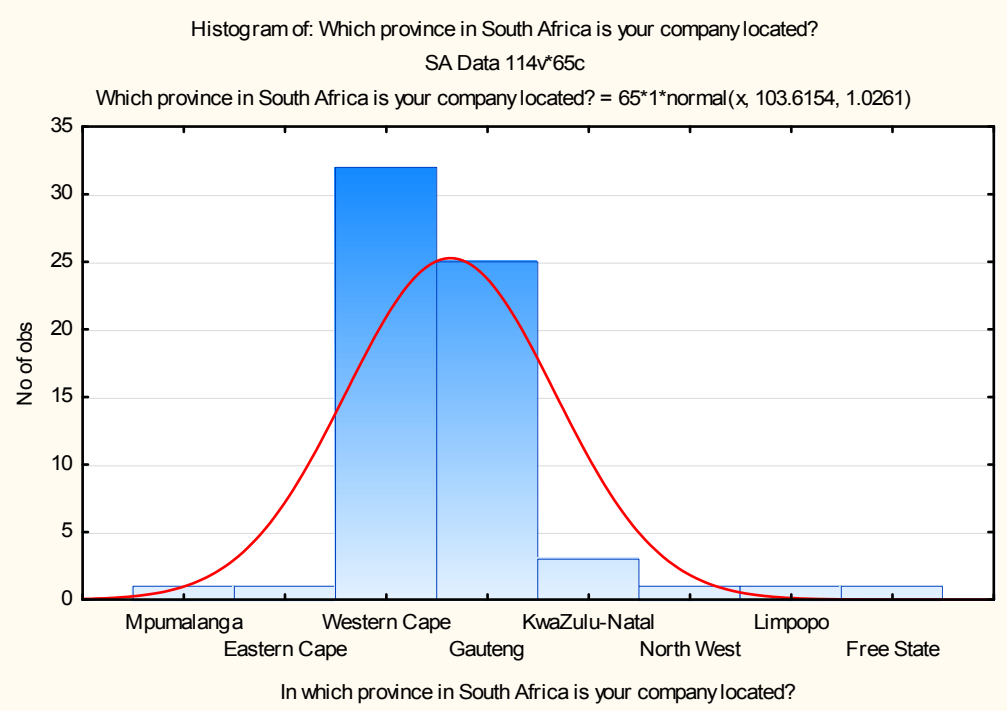

Figure 3: Location of SMEs in the sample

4.2.2. Size of organisation

Table 2 shows the size of the organisations sampled, based on the number of employees. This further indicates that all respondents are from SMEs (less than 250 employees) (National Small Business Amendment Act, 2003), with 54% employing less than 21 people.

No of employees	Sample size in percentage
1-5	32%
6-10	9%
11-20	13%
21-50	17%
51-100	6%
101-200	6%
201-249	17%

Table 2: Size of Organisation based on the number of employees

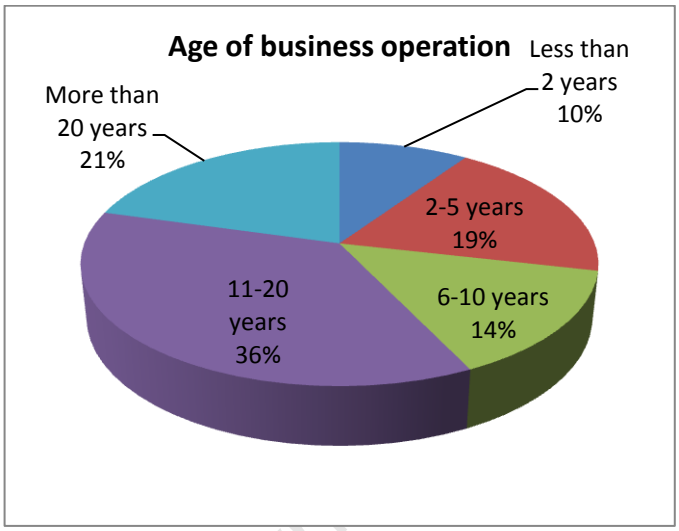

Figure 4: Age of business operation

4.2.3. Age of business operation

Figure 4 shows that 57% of SMEs in the sample had been in operation for more than ten years, so should have had ample time to reap the benefits of ICT. As it is noted that 60% of new firms fail within the first three years of establishment (Gibb, 2000), this sample of SMEs appears to be of the more resilient SMEs, as over 70% had been in operation for longer than five years.

4.2.4. Type of industry

If one combines SMEs from the ICT and Manufacturing sectors, they make up 49% of the respondents, as shown in Figure 5. The fact that 26% of respondents were from the Manufacturing sector was to be expected, as were the 23% from the ICT sector. This is in line with the observation by Kotelnikov (2007) that Manufacturing firms are more likely to use ICT than other sectors. Financial and Business Services, Retail, Accommodation, Education and Construction sectors comprised 9%, 9%, 8%, 6% and 5% respectively. 'Other' sectors include Non-profit organisations, Advertising, Religions, Government, Publishing, Healthcare, Textile, Promotional printing,

Organisation Development, Consulting, Forensic Services, Online Marketing, Transportation, Restaurants and Community building.

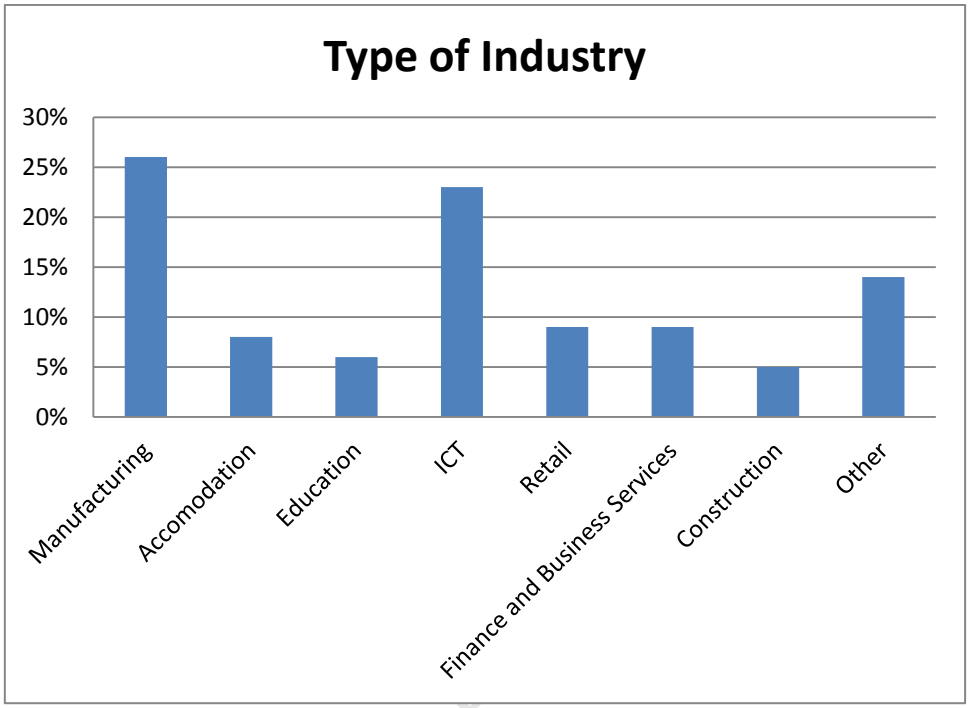

Figure 5: Type of Industry

4.3. Testing relationships and goodness of constructs

It is important to know the collinearity (relationship) between independent constructs, as well as conducting both reliability and validity tests for all the constructs (Cavana *et al.*, 2001). Collinearity (sometimes called multicollinearity) exists when "there are strong linear relationships among independent variables" (Allison, 1999; Kleinbaum, Kupper, Nizam & Muller, 2008, p. 305). The reliability and validity tests measure the goodness of the constructs: reliability tests measure the extent to which the measure (construct) is error free, while validity tests ensure the ability of the constructs to measure the intended concept (Cavana *et al.*, 2001). The correlation, reliability and validity tests of the measuring instruments (independent and dependent constructs) are therefore presented.

4.3.1. Relationships of constructs

To measure the strength of the relationship between DC constructs and ICT utilisation constructs, [there is no need to find the correlation between the competitive advantage constructs, because multicollinearity does not affect the dependent variable (Allison, 1999)], a Spearman rank order correlation was conducted (details of all statistical tests can be found in Appendix C). A Spearman rank order correlation was considered appropriate to evaluate the strength of the relationship between the constructs, since DC and ICT utilisation constructs were measured on an ordinal scale (Cavana *et al.*, 2001).

ICT utilisation constructs: Table 21 (in Appendix C) shows that most of the constructs are significant at $p < 0.001$ and no correlation exceeded 0.63, which means the constructs are different from each other (Cavana *et al.*, 2001).

DC constructs: From Table 22 (in Appendix C), it can be deduced that sensing capability was split into Sensing-Cap1 and Sensing-Cap2 for testing purposes and to check for consistency of the respondents. The same applies to adaptive, innovative and integrative capability constructs.

Table 22 (in Appendix C) confirms a high correlation between the sensing capability constructs (Sensing-Cap1 and Sensing-Cap2) and integrative capability constructs (Integrative-Cap2 and Integrative-Cap3, Integrative-Cap3 and Integrative-Cap4, Integrative-Cap3 and Integrative-Cap5, Integrative-Cap4 and Integrative-Cap5). The analysis further shows near extreme multicollinearity between Integrative-Cap1 and Innovative-Cap1, Integrative-Cap5 and Adaptive-Cap2, and Integrative-Cap5 and Innovative-Cape1. This might be due to similarity between the questions. However, near extreme multicollinearity will only affect the coefficient estimates for variables that are collinear (Allison, 1999).

According to Cavana *et al.* (2001, p. 328), "if correlation were higher (say, 0.75 and above), we might have to question whether the correlated variables are two different and distinct variables", which means that only the correlation between Integrative-Cap1 and Innovative-Cap1 (0.7788) exceeds 0.75. According to Ott and Longnecker (2010, p. 765), "any correlation over 0.9 or so definitely indicates a serious problem". In this study, multicollinearity was treated by removing all the correlation (Sensing-Cap1, Integrative-Cap1, Integrative-Cap3 and Integrative-Cap5) that exceeded 0.70 before conducting any further analysis (see Table 23 in Appendix C).

4.3.2. Reliability of constructs

The reliability test in Table 24 (in Appendix C) reveals that all the constructs had Cronbach alpha (α) coefficients above 0.90, which is acceptable for exploratory (Cavana *et al.*, 2001), as well as for confirmatory, studies (Parida *et al.*, 2009).

It may be concluded that the measuring instrument is reliable and the internal consistency reliability of the constructs is good (Cavana *et al.*, 2001).

4.3.3. Validity of constructs

The factor analysis was used to determine construct validity: factor analysis examines the actual constructs as perceived by the respondents (Cavana *et al.*, 2001). Factor analysis is "reckoned as a best-known statistical procedure for testing a hypothesised factor structure" (Wang & Ahmed, 2004, p. 306), and was used to test the validity of all the constructs (competitive advantage, ICT utilisation and DCs). The cut off was set to 0.5; this was considered appropriate considering that this study is exploratory and because of the small sample size: "Some texts recommend only using loadings greater than 0.4" (Cavana *et al.*, 2001, p. 439).

Table 25 (in Appendix C) shows that the respondents were clear about the questions and all the factors except "handle transaction" loaded. By using Varimax normalised, each of the constructs loaded to only one of three factors, without having any cross loading and the three factors explained above 56% of the variance in the data (see Table 3).

Eigenvalues (SA Data) Extraction: Principal components				
Factor	Eigenvalue	% Total - variance	Cumulative – Eigenvalue	Cumulative - %
1	8.843184	36.84660	8.84318	36.84660
2	2.932714	12.21964	11.77590	49.06624
3	1.812688	7.55287	13.58859	56.61911

Table 3: Variance explained by 3 factors

Factor 1 is DCs which includes 11 constructs (Sensing-Cap2, Absorptive-Cap, Adaptive-Cap1, Adaptive-Cap2, Innovative-Cap1, Innovative-Cap2, Networking-Cap, Integrative-Cap2, Integative-Cap4, Behavioural-Innov1 and Behavioural-Innov2). Factor 2 is ICT utilisation which includes seven constructs (Cost saving, Establish collaboration, Maintain collaboration, Handle collaboration, Handle communication, Establish relationship and Strategic planning), and Factor 3 is competitive advantage which includes all the five constructs predicted (Process-Innov, Market-Innov, Strategic-Innov, Product-Innov1 and Product-Innov2). It was discovered that all three factors have at least five constructs; hence the factors are considered stable (Costello & Osborne, 2005).

However, the statistical analysis indicated Behavioural-Innov1 and Behavioural-Innov2 constructs, that were predicted to be competitive advantage constructs, are actually DCs constructs. This might be due to the way the questions were worded. Therefore, Behavioural-Innov1 and Behavioural-

Innov2 were grouped as part of DCs constructs in subsequent analysis. The construct (Handle transaction) that did not load on any of the factors was removed from subsequent analysis.

4.3.4. Correlation of emerged DCs constructs

To further address the issue of multicollinearity among DCs constructs, a Spearman rank order correlation was conducted on all the constructs that statistically emerged as DCs constructs. Table 26 (Appendix C) confirms a high correlation between Behavioural-Innov1 and Behavioural-Innov2, and multicollinearity between Adaptive-Cap2 and Behavioural-Innov2. This was handled by removing Behavioural-Innov2 from subsequent analysis.

4.3.5. Characteristics of responses

It was considered necessary to know the characteristics (normality) of the responses (Cavana *et al.*, 2001). All the constructs were measured on the Likert scale of 1 to 5. It can be deduced from Table 27 (in Appendix D) that all the constructs, except constructs measuring process innovativeness (Process-Innov) and the size of the organisation, had a mean above average (mean > 3). This indicates that respondents in general agreed with the questions that the constructs measured. The findings clearly indicate that the responses were not normally distributed, but the values of standard deviation (Std. Dev.) show that the respondents were distributed around the mean. The next section highlights what the scale represents for each variable.

4.3.5.1.Measuring scale

All constructs were measured on a 5 point Likert scale. The five competitive advantage constructs (Process-Innov, Market-Innov, Strategic-Innov, Product-Innov1 and Product-Innov2) were measured on the scale: Never, Every two years, Annually, Twice a year and Three times a year. The seven ICT utilisation constructs (Cost saving, Establish collaboration, Maintain collaboration, Handle collaboration, Handle communication, Establish relationship and Strategic planning) were measured on the scale: Not at all, Very rarely, Neutral, Occasionally and To a very large extent, and the ten

DCs constructs (Sensing-Cap2, Absorptive-Cap, Adaptive-Cap1, Adaptive-Cap2, Innovative-Cap1, Innovative-Cap2, Networking-Cap, Integrative-Cap2, Integative-Cap4 and Behavioural-Innov1) were measured on the scale: Strongly disagree, Disagree, Neutral, Agree and Strongly agree. The next section discusses the descriptive research questions as highlighted in section 1.3.

4.4. Discussion of descriptive research questions

4.4.1. Descriptive question 'a': What gives South African SMEs competitive advantage in dynamic environments?

Through the semi-structured questions, attempts were made to discover what gives South African SMEs competitive advantage. The findings indicated that innovation, networking capability, behavioural innovativeness, adaptive capability and DCs (as shown in Table 4), are sources of competitive advantage. This is consistent with the literature; the findings show that DCs have an impact on competitive advantage. Networking plays "an important role in shaping business outcomes" (Tsai, 2001, p. 1003). Most of the respondents indicated that innovation and networking are important to achieve competitive advantage: *"Innovation is important because that's how you solve problems, address challenges, diversify your offerings and retain your edge"*, and that innovation is a continuous process, "*But then you have to keep working and innovating, to ensure that your brand continues to meet and sometimes exceeds the expectations of your customers*". This is consistent with the literature. Competitive advantage is obtained through continuous development of valuable assets (Augier & Teece, 2008; Teece, 2007).

Competitive advantage	Example of responses from some of the respondents
Innovation	Range of products and the styles we offer are unique to the market. Unique designs.
Behavioural innovativeness	Our agility and openness to new ideas. Willing to adjust at a moment's notice to meet customers' requests. Our culture and thinking (vision). Our people product / service offering and value delivered through our processes and technology visionary leaders. Multi-cultural knowledge, racial mix.
Networking capability	We have a good network of suppliers that provide us with the highest possible quality of products that form part of our product offering. Strong networking and joint venture agreements. We partner with experts in their field so that we don't have to be experts; we can focus on areas we have expertise. Our geographic positioning.
Adaptive capability	Our willingness to adapt to new and changing environments. See to want the industry needs are, and adapt. Our marketing and willingness to adapt. Ability to adapt to change quickly.
Dynamic capabilities	The ability to change and adapt products to customer tastes and requirements. We offer diversity in our training programmes, community services and projects.

Table 4: What gives South African SMEs competitive advantage?

4.4.2. Descriptive research question 'b': How are South African SMEs using ICT in dynamic environments?

This section presents the analysis on levels and purposes of ICT utilisation. Based on their responses, the respondents were categorised into BC capability, BIT capability, AC capability and AIT capability levels, as defined in the literature (Kotelnikov, 2007). It was found that South African SMEs have moved beyond BC capability level; this may be due to the data collection technique of the online questionnaire. Of the sample, 38% had BIT capability, 26% had AC capability and the remaining 36% had AIT capability (Figure 6).

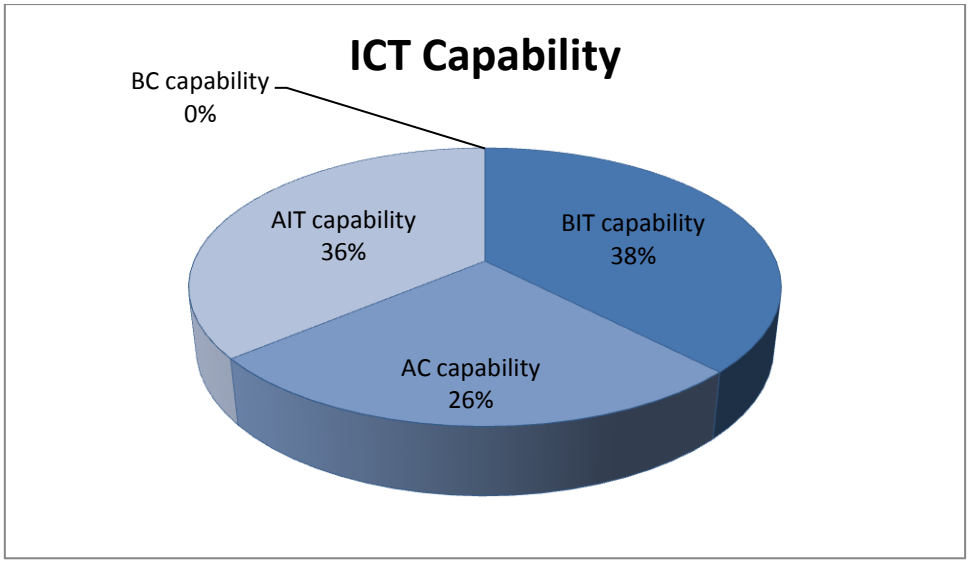

Figure 6: Categorisation of ICT capability of the sample

Based on the findings of this sample, South African SMEs are high users of ICT; this result differs from the study conducted in the Asia-Pacific region (Kotelnikov, 2007), who found that 90% of Thai SMEs were at the BC capability level. This finding is consistent with the study conducted in Sweden (Parida *et al.*, 2009) – Parida *et al.*, (2009) found that the majority of Swedish small firms are high users of ICT.

To further investigate how South African SMEs use ICT, the mean values for SMEs under BIT capability, AC capability and AIT capability in relation to ICT utilisation were obtained. Table 5 depicts the average response for SMEs under BIT capability is between 3 (Neutral) and 5 (To a very large extent). The average response for SMEs under AC capability and AIT capability is between 4 (Occasionally) and 5 (To a very large extent).

Variable	Mean	Standard deviation	Mean Value for SMEs under:		
			BIT capability	AC capability	AIT capability
Cost saving	4.4462	0.9847	4.0800	4.7059	4.6522
Establish collaboration	4.3692	1.0690	4.0400	4.7059	4.4783
Maintain collaboration	4.6935	0.6675	4.5217	4.9412	4.6818
Handle collaboration	4.3077	1.1029	3.6800	4.6471	4.7391
Handle communication	4.3692	1.0835	3.8800	4.5294	4.7826
Establish relationship	4.4615	0.8492	4.2400	4.7647	4.4783
Strategic planning	4.1385	1.0289	3.8800	4.4706	4.1739

Table 5: Mean value for SMEs under BIT, AC and AIT capabilities in relation to ICT utilisation

The statistical evidence gathered shows that, regardless of the capability level, South African SMEs use ICT for cost saving, to collaborate with new and existing business partners, to handle collaboration within the firm and communication with the firm's stakeholders, to establish relationships with other organisations and to enable strategic planning. This finding is consistent with the literature. Parida *et al.*, (2009) found that Swedish small firms use ICT for collaboration, to access information, for maintaining relations with partners and to achieve better internal communications. The next section describes the survey samples in each capability level (BIT, AC and AIT).

4.4.2.1.Basic information technology (BIT) capability level

Of those SMEs with BIT capability, 56% have less than 11 employees (see Table 6). Examining the SMEs with BIT capability, it can be deduced from Figure 7 that 48% had been in operation for more than ten years; the age of the business operation does not appear to have a strong influence on BIT capability. One would have expected that mature firms would have had advanced capabilities and would not still be at the BIT capability level.

No of employees	Sample size in percentage
1-5	40%
6-10	16%
11-20	16%
21-50	12%
51-100	8%
101-200	0%
201-249	8%

Table 6: Size of SMEs under BIT capability

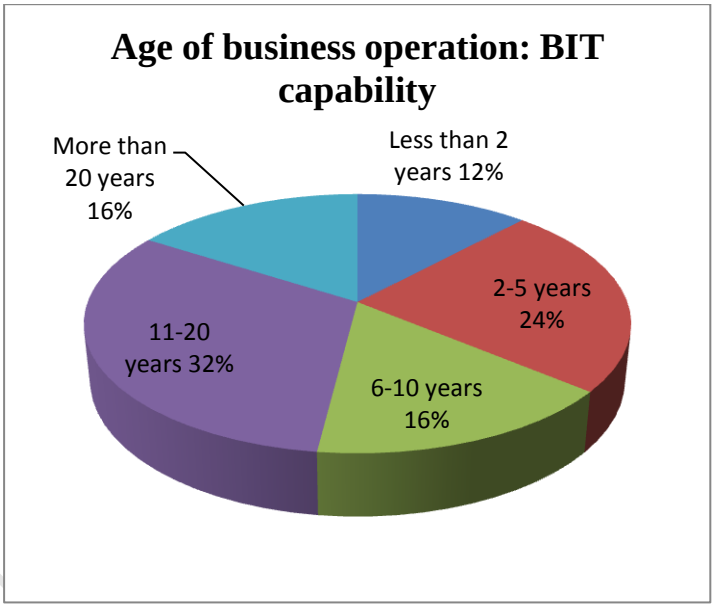

Figure 7: Age of business operation of SMEs under BIT capability

Further consideration of SMEs with BIT capability shows that the highest percentage of the sample were found to be from Manufacturing (20%), Accommodation (20%) and ICT (20%) sectors, as shown in Figure 8.

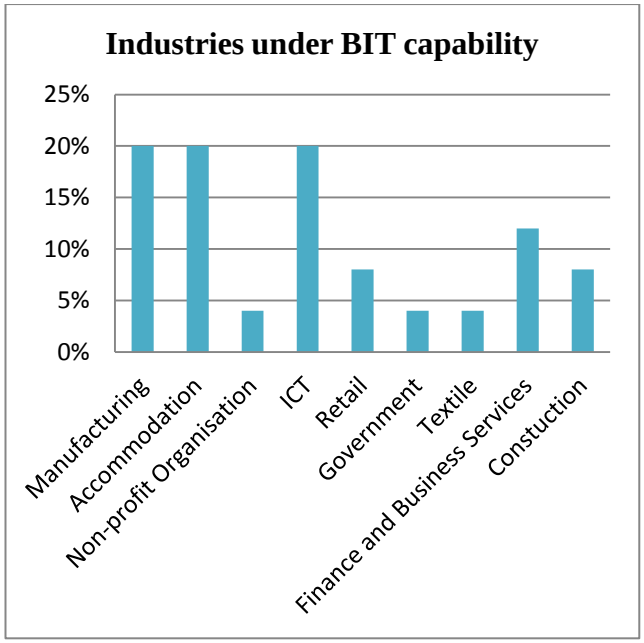

Figure 8: Industries under BIT capability

Age of business operation	Percentage in the sample		No of employees
Less than 2 years	-		-
2 – 5 years	40%	20%	11 – 20
		20%	51 – 100
6 -10 years	-		-
11 – 20 years	40%	20%	11 – 20
		20%	21 – 50
More than 20 years	20%		21 – 50

Table 7: Details of Manufacturing sector under BIT capability

Further analysis was carried out on Manufacturing, Accommodation and ICT sectors. Table 7 shows that 60% of the Manufacturing sector sampled with BIT capability had more than 20 employees, while 60% had been in operation for more than 11 years.

Age of business operation	Percentage in the sample	No of employees
Less than 2 years	20%	1 - 5
2 – 5 years	40%	1 – 5
6 -10 years	-	-
11 – 20 years	20%	6 – 10
More than 20 years	20%	11 – 20

Table 8: Details of Accommodation sector under BIT capability

Age of business operation	Percentage in the sample	No of employees
Less than 2 years	20%	1 – 5
2 – 5 years	20%	1 – 5
6 -10 years	20%	6 – 10
11 – 20 years	20%	1 – 5
More than 20 years	20%	11 – 20

Table 9: Details of ICT sector under BIT capability

It was discovered that 60% of the SMEs in the Accommodation sector sample with BIT capability (see Table 8) had less than six employees, while 60% had been in operation for less than six years.

It can be deduced from Table 9 that SMEs in the ICT sector sample with BIT capability have a similar trend to the SMEs in the Accommodation sector (Table 8), with 60% of the sample having less than six employees, and 60% having been in operation for less than 11 years.

4.4.2.1.1. Use of various BIT applications, tools, software and functions for business purposes

Respondents were asked to indicate various ICT applications and functions they use and to specify the purpose thereof. Figure 9 (see Appendix E 1 for details) shows that the majority (72%) use mobile phones for communication with customers and suppliers. Above 70% of respondents indicated they use a PC – for obtaining information (72%), to store information (96%) and for banking (76%).

More than 70% used intranet/internet for obtaining information (88%), for banking (80%), for purchasing (72%), for marketing (72%), for finding partners locally and internationally (72%) and for new business opportunities (88%). More than 70% used their websites for marketing (76%) and for new business opportunities (72%).

Those who indicated that they used PCs to store information amounted to 96%; fewer used mobile phones (28%), internet/intranet (40%) and websites (32%) to store information. The low usage of percentage of respondents using the websites to store information is to be expected as services such as Google Documents are relatively new (Douglas, Wainwright & Greenwood, 2010).

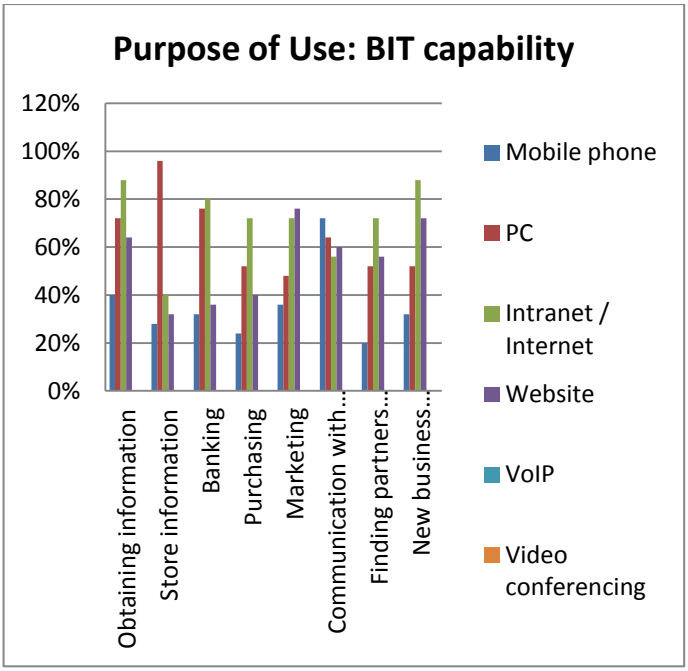

Figure 9: For what purpose do SMEs under BIT capability use ICT applications and functions?

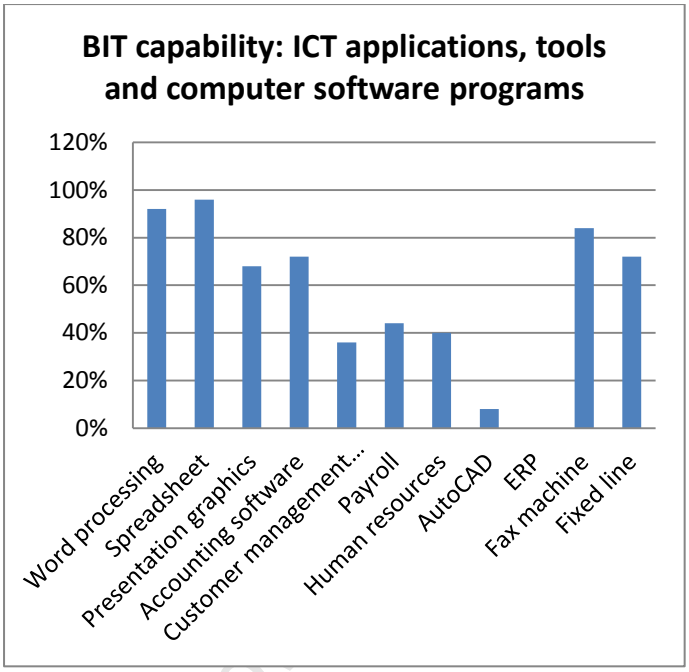

Figure 10: BIT – ICT applications, tools and computer software programs

Respondents were asked to indicate the ICT applications, tools or computer software programs (word processing, spreadsheets, presentation graphics, accounting software, customer management software, payroll, human resources, ERP, AutoCAD, fax machine and fixed line) that they use for business purposes. Figure 10 indicates that the majority used word processing (92%), spreadsheets (96%), accounting software (72%), fax machine (84%) and fixed line (72%). Fewer used customer management software (36%), AutoCAD (6%) and none used ERP (0%).

Table 10 shows the additional ICT applications, tools or computer software programs indicated by the respondents under BIT capability level.

	Database, development, analysis tools (e.g. visual studio, Visio, sql, etc).

	Access.
	Graphics editor (the GIMP) Website. Development Tools.
	Scanner to email documents.
	Budgeting tools.
	CorelDraw.
	Booking System.
	GIS and Mind map.
	Software developer programmes databases.
	Use of marketing via cell phones – SMS, MMS Use of USSD applications via the cell network.

Table 10: BIT capability: Additional ICT applications, tools or computer software programs

4.4.2.2.Advanced communications (AC) capability

Of the SMEs with AC capability, 70% had less than 11 employees (as shown in Table 11), and 35% had been in operation for more than ten years (as shown in Figure 11).

No of employees	Sample size in percentage
1-5	59%
6-10	11%
11-20	0%
21-50	12%
51-100	0%
101-200	12%
201-249	6%

Table 11: Size of SMEs under AC capability

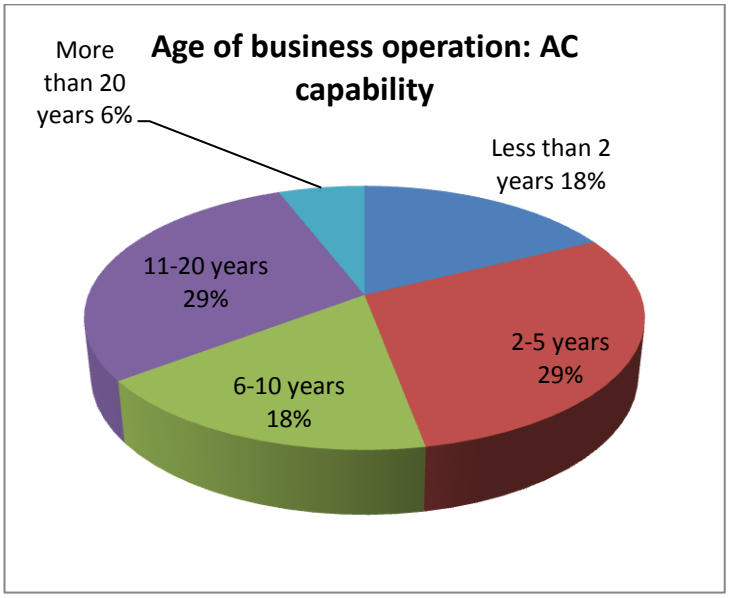

Figure 11: Age of business operation of SMEs under AC capability

Further analysis reveals that the highest percentage (29%) of the sample was found to be from the ICT sector, follow by Finance and Business services (12%), Education and Retail sectors, with Manufacturing, Publishing, Advertising and Construction sectors having 6% each (as shown in Figure 12).

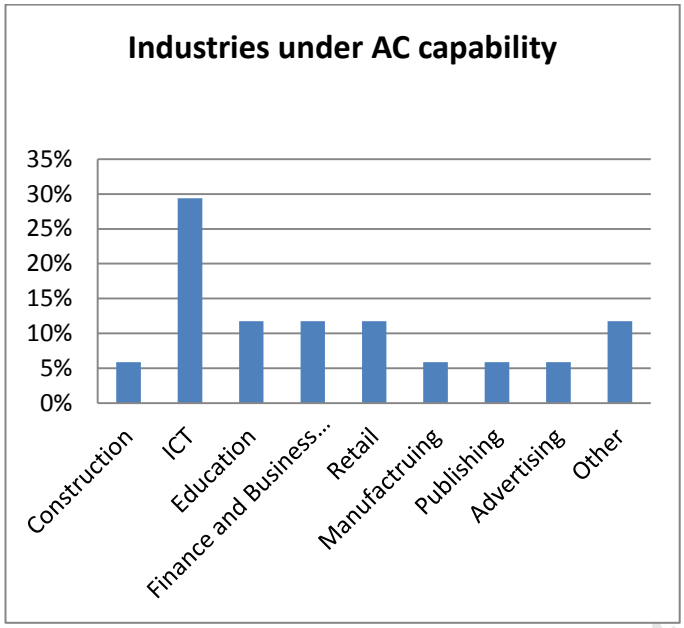

Figure 12: Industries under AC capability

Age of business operation	Percentage in the sample		No of employees
Less than 2 years	20%		1-5
2 – 5 years	20%		101-200
6 -10 years	40%	20%	1-5
		20%	21-50
11 – 20 years	20%		1-5
More than 20 years	-		-

Table 12: Details of ICT sector under AC capability

Further analysis was carried out on the ICT, Finance and Business services, and Retail sectors. It was discovered that 60% of the ICT sector sample with AC capability (see Table 12) had less than six employees, 20% had more than ten employees, and 80% had been in operation for less than 11 years.

Table 13: Details of Finance and Business Services sector under AC capability

Age of business operation	Percentage in the sample	No of employees
Less than 2 years	-	-
2 – 5 years	-	-
6 -10 years	-	-
11 – 20 years	34%	1-5
More than 20 years	66%	201-249

Age of business operation	Percentage in the sample	No of employees
Less than 2 years	50%	1 – 5
2 – 5 years	-	-
6 -10 years	-	-
11 – 20 years	50%	21 – 50
More than 20 years	-	-

Table 14: Details of Retail sector under AC capability

It can be deduced from Table 13 that 66% of the Finance and Business Services sector sample with AC capability had between 201 and 249 employees and had been in operation for more than 20 years.

Table 14 indicates that 50% of the Retail sector sample with AC capability had between one and five employees and had been in operation for less than 2 years, while 50% had between 21 and 50 employees and had been in operation from between 11 and 20 years.

4.4.2.2.1. Use of various AC applications, tools, software and functions for business purposes

It can be deduced from Figure 13 (see Appendix E 2 for details) that the mobile phones are highly used for communication with customers and suppliers (94%), for obtaining information (76%) and for new business opportunities (65%). More than 70% of the respondents indicated that they use PCs for obtaining information (88%), to store information (100%), for banking (82%) and for marketing (71%). The intranet/internet is highly used for obtaining information (100%), for banking (94%), for purchasing (94%), for marketing (94%), for communication with customers and suppliers (88%), for finding partners locally and internationally (94%) and for new business opportunities (88%). More than 60% use their website for obtaining information (65%), for marketing (82%) and for communication with customers and suppliers (65%).

SMEs under AC capability level also use VoIP (59%) and video conferencing (47%) for communication with customers and suppliers. Fewer use VoIP (6%) and video conferencing (6%) for purchasing.

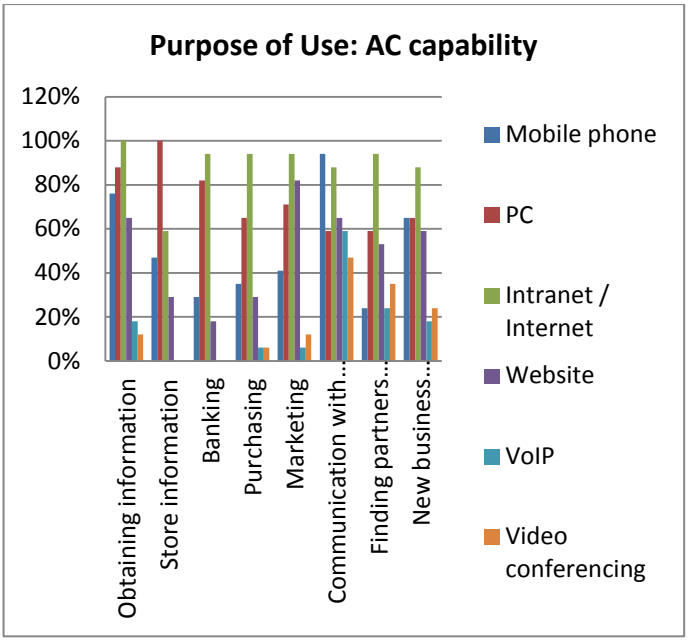

Figure 13: For what purpose do SMEs under AC capability use ICT applications and functions?

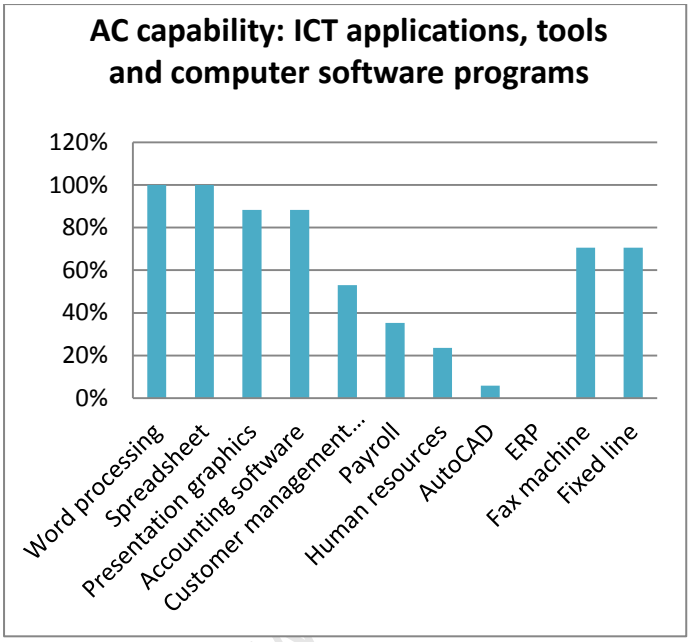

Figure 14: AC – ICT applications, tools and computer software programs

Figure 14 indicates all the respondents under AC capability use word processing and spreadsheet. More than 70% use presentation graphics (88%), accounting software (88%), fax machine (71%) and fixed line (71%). Fewer use human resources (24%), AutoCAD (6%) and ERP (0%). Table 15 depicts the additional ICT applications, tools or computer software programs indicated by the respondents under AC capability.

	Note-taking apps, outlining apps, mind mapping apps, graphic design apps, photo editing apps, versioning systems, screen casting apps, text editors for coding, Twitter clients, and more. I generally have about 15 to 20 apps running simultaneously on my Mac.

	All email, collaboration and online storage is done via Google Apps / cloud storage.
	Open Source development tools, including database Modelling software SaaS based company email, calendar, Internet and intranet Open source graphics creation software Virtualization software.
	Case Management Project and task management Asset Management Document management Firewalls, DNS and Directory systems Operating system and Database.
	Graphic applications such as Photoshop.
	Databases (Ms Access).
	Computer fax.

Table 15: AC capability: Additional ICT applications, tools or computer software programs

4.4.2.3. Advanced information technology (AIT) capability

Table 16 shows that 4% of SMEs with AIT capability have less than 11 employees. Those that had been in operation for more than ten years made up 78% (see Figure 15).

No of employees	Sample size in percentage
1-5	4%
6-10	0%
11-20	17%
21-50	26%
51-100	9%
101-200	9%
201-249	35%

Table 16: Size of SMEs under AIT capability

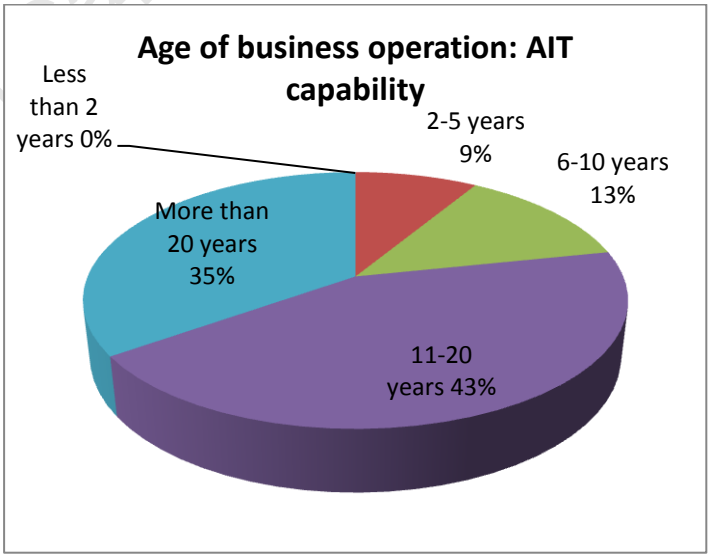

Figure 15: Age of business operation of SMEs under AIT capability

Further consideration of SMEs with AIT capability shows that the highest percentage (48%) of the sample was found to be from the Manufacturing sector, with 22% being from the ICT sector, as shown in Figure 16.

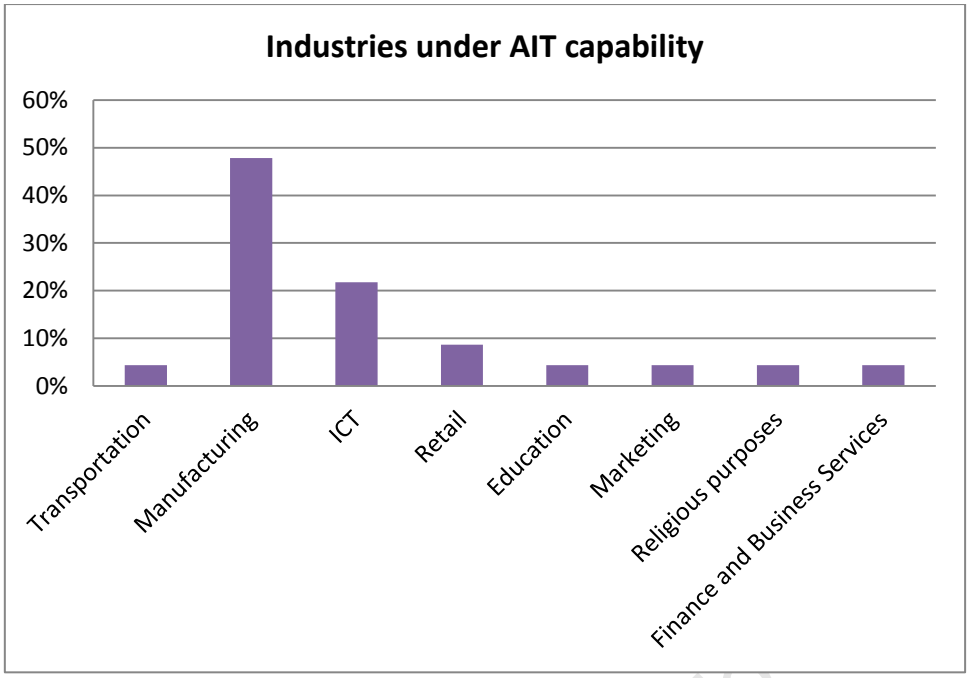

Figure 16: Industries under AIT capability

Further analysis was carried out on the Manufacturing and ICT sectors. It was discovered that 9% of the Manufacturing sector sample with AIT capability (see Table 17) have less than six employees and 55% have more than 20 employees. Those that had been in operation for more than ten years totalled 64%.

Table 18 shows that 100% of the ICT sector sample with AIT capability had more than 100 employees, and had been in operation for more than ten years.

business operation	sample		employees
Less than 2 years	-		-
2 – 5 years		9%	1 – 5

Age of business operation	Percentage in the sample		No of employees
	18%	9%	51 – 100
6 – 10 years	18%		11 – 20
11 – 20 years	54%	18%	11 – 20
		36%	21 – 50
More than 20 years	10%		21 – 50

Table 17: Details of the Manufacturing sector under AIT capability

Age of business operation	sample		employees
Less than 2 years	-		-
2 – 5 years	-		-
6 -10 years	-		-
11 – 20 years	75%	25%	101 – 200
		50%	201 – 249
More than 20 years	25%		201 – 249

Table 18: Details of ICT sector under AIT capability

4.4.2.3.1. Use of various AIT applications, tools, software and functions for business purposes

It can be deduced from Figure 17 (see Appendix E 3 for details) that mobile phones are highly used for obtaining information (65%), for marketing (65%), for communication with customers and suppliers (74%) and for new business opportunities (70%). Fewer respondents use mobile phones for banking (17%) and for purchasing (22%). More than 70% of the respondents indicated that they use PCs for obtaining information (91%), to store information (100%), for banking (87%), for purchasing (83%), for communication with customers and suppliers (83%), for finding partners locally and internationally (74%) and for new business opportunities (78%).

The intranet/internet is highly used for obtaining information (91%), to store information (70%), for banking (87%), for purchasing (87%), for marketing (83%), for communication with customers and suppliers (96%), for finding partners locally and internationally (87%) and for new business opportunities (87%). More than 70% of respondents use their websites for obtaining information (83%), for marketing (91%), for finding partners locally and internationally (74%) and for new business opportunities (83%). SMEs under AIT capability also used VoIP for obtaining information

(48%), for communication with customers and suppliers (52%), for finding partners locally and internationally (43%), for new business opportunities (43%), to use video conferencing for obtaining information (26%), for communication with customers and suppliers (43%), for finding partners locally and internationally (39%) and for new business opportunities (26%).

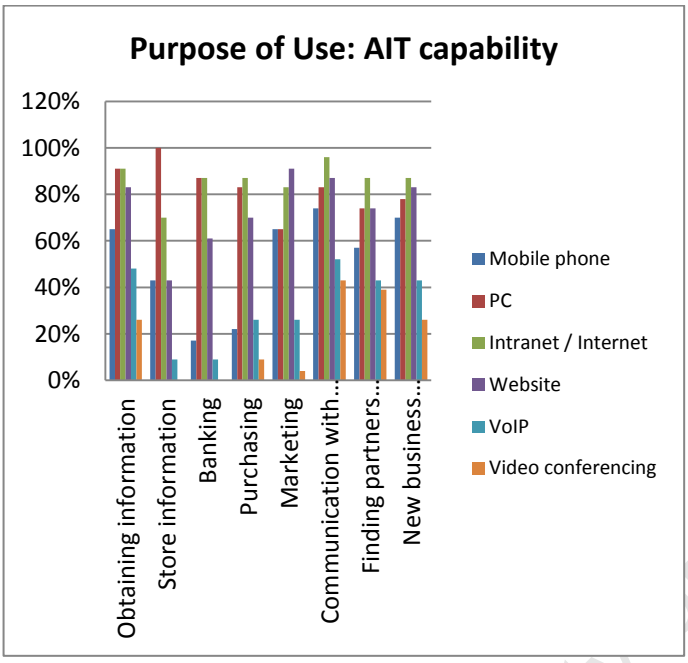

Figure 17: For what purpose do SMEs under AIT capability use ICT applications and functions?

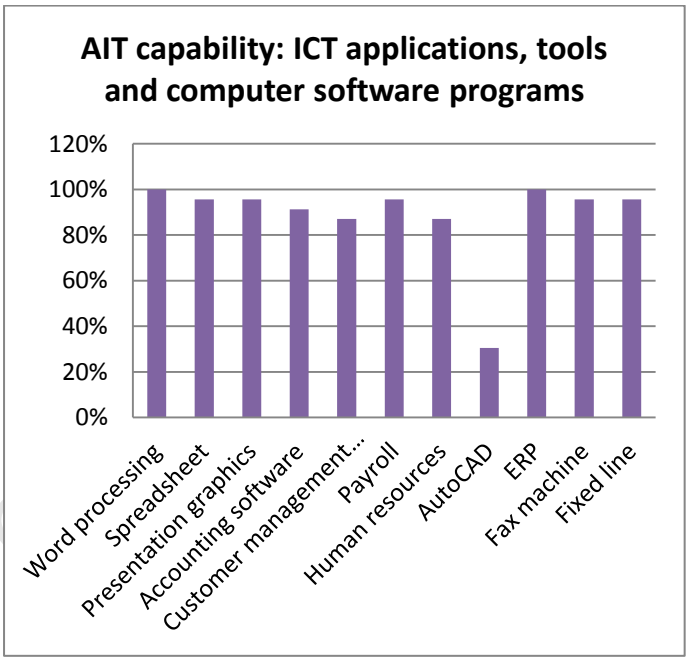

Figure 18: AIT – ICT applications, tools and computer software programs

It can be deduced from Figure 18 that all the respondents under AIT capability use word processing and ERP. More than 80% indicated they use all the specified ICT applications, tools or computer software programs except AutoCAD (30%), but this is still significantly higher than BIT capability (0%) and AC capability (10%) users. Table 19 shows the additional ICT applications, tools or computer software programs indicated by the respondents under AIT capability.

	Business Intelligence, Data warehousing,

Additional ICT applications, tools or computer software programs indicated by respondents under AIT capability	**Mediation.**
	Cameo v.4- an apparel pattern development software for professional pattern makers. This helps with our designs.

Table 19: AIT capability: Additional ICT applications, tools or computer software programs

4.4.2.4. Summary on how South African SMEs use ICT in dynamic environments

Regarding the use of various ICT applications, tools and software for business purposes, across the three capability levels, the mobile phone is highly used for communication with customers and suppliers. SMEs under AC and AIT capability levels also significantly use mobile phones for obtaining information and for new business opportunities. In addition, SMEs under AIT capability level use the mobile phone for marketing. The PC is highly used across the three capability levels for obtaining information, to store information and for banking. SMEs under AIT capability level significantly use PCs for purchasing, for communication with customers and suppliers, for finding partners locally and internationally and for new business opportunities.

The findings show that all SMEs across various capability levels use intranet/internet for obtaining information, for banking, for purchasing, for marketing, for finding partners locally and internationally and for new business opportunities. In addition, SMEs under AC and AIT capability levels use intranet/internet for communication with customers and suppliers.

The website is mostly used by SMEs under BIT capability level for marketing and new business opportunities, by SMEs under AC capability level for marketing, and by SMEs under AIT capability level for obtaining information, for purchasing, for marketing, for communication with customers and suppliers, for finding partners locally and internationally and for new business opportunities.

VoIP and video conferencing appear to be the least used technology across all the three capability levels. However, SMEs under AC capability level use VoIP and video conferencing for

communication with customers and suppliers. SMEs under AIT capability level use VoIP to an extent: for obtaining information, for communication with customers and suppliers, for finding partners locally and internationally and for new business opportunities. SMEs under AIT capability level also use video conferencing for communication with customers and suppliers, and for finding partners locally and internationally.

It can be deduced from Tables 10, 15 and 19, that South African SMEs are high users of ICT, regardless of the capability level. Most of the additional ICT applications, tools and computer software programs that were highlighted by the respondents in various capability levels are advanced technologies.

4.4.3. Descriptive question 'c': What is the contingent effect of firm size and age on ICT capabilities?

The findings from section 4.4.2 show a similar trend between SMEs under BIT and AC capability levels: the majority of SMEs under BIT (56%) and AC (70%) capability levels had less than 11 employees, while less than half of BIT (48%) and AC (44%) had been in operation for more than ten years. BIT capability level is dominated by the Manufacturing (20%), Accommodation (20%) and ICT (20%) sectors. AC capability level is dominated by the ICT (29%) sector, out of which 60% had less than six employees, while 80% had been in operation for less than 11 years.

In the case of SMEs under AIT capability level, almost all (96%) had more than 11 employees, and 78% had been in operation for more than ten years and were dominated by the Manufacturing (48%) and ICT sectors (22%).

Comparing the ICT sector across the three capability levels, it was discovered that a similar trend occurs between the ICT sector under BIT and AC capability levels. Of the ICT sector under BIT

capability level, 60% had less than six employees, while 60% had been in operation for less than 11 years. Similarly, 60% of the ICT sector under AC capability level had less than six employees and 80% had been in operation for less than 11 years. While 100% of ICT sector under AIT capability level had more than 100 employees, 100% had been in operation for more than ten years.

Also, comparing the Manufacturing sector under BIT and AIT capability levels, it was discovered that 60% of SMEs under BIT capability level had more than 20 employees and had been in operation for more than 11 years, while 55% of SMEs under AIT capability level had more than 20 employees and 64% had been in operation for more than ten years.

4.5. Hypotheses testing and discussion of exploratory questions

This section presents the five hypotheses, in order to address the exploratory research questions highlighted in section 1.3. This study consistently followed four general procedures while testing the hypotheses, which includes:

1. Stating the null (H_0) and alternative hypothesis (H_A)
2. Forming the rejection or nonrejection rule (p-value)
3. Computing the statistical test and
4. Drawing conclusions regarding rejection or non-rejection of hypothesis (Kleinbaum *et al.*, 2008).

All the hypotheses generated in this study examine the impacts (causal relationships) of more than one construct (independent variable) on the dependent variable. This calls for use of structural equation modelling (SEM). SEM is suitable for measuring complex cause-effect relationships (Vinzi, Chin, Henseler & Wang, 2010). "The strength of SEM lies in its ability to rigorously test a hypothesized model of relations among manifest and latent variables" (Tinsley & Brown, 2000, p. 440). Manifest variables are variables that are directly measured such as Cost saving, Sensing

capability etc. (in the case of this study), while latent variables are variables that cannot be measured directly, such as DCs, ICT utilisation and Competitive advantage (in the case of this study) (Sheskin, 2007).

The Partial Least Square (PLS) approach to SEM was considered appropriate, because PLS can simultaneously test the relationships between manifest variables and their corresponding latent variables, as well as the relationships between constructs (Vinzi *et al.*, 2010). Among all the available PLS software packages, WarpPlus 2.0 was selected because "it uses the non-linearity of construct relationships to develop the path coefficient and significance" (Brewster, 2011, p. 20). WarpPlus has a unique analysis technique: WarpPlus starts by identifying an S-curve relationship and if the relationship does not exist, it attempts to identify a U-curve relationship before considering an optimal linear relationship, and uses a bootstrapping resampling method for estimating the generalisability of multivariate results (Brewster, 2011). In actual sense, a non-linearity relationship may best describe the phenomena under study.

Using the WarpPlus 2.0 software package to perform PLS, Figures 19 – 23 were generated for each hypothesis to investigate the impacts of: ICT utilisation on competitive advantage, ICT utilisation on DCs, DCs on competitive advantage, DCs on ICT utilisation, firm size and age on ICT utilisation, and absorptive and innovative capabilities.

4.5.1. Exploratory Research question 1: How do ICT utilisations impact on competitive advantage of South African SMEs in dynamic environments?

Hypothesis 1: Impacts of ICT utilisation on Competitive advantage
Hypothesis 1 can be stated in the null ($H1_0$) and alternate ($H1_A$) as follows:

$H1_0$: *ICT utilisation will not have significant impacts on competitive advantage.*

Statistically expressed as $H1_0$: $p_{I\text{-}C} \geq 0.05$

$H1_A$: *ICT utilisation will have significant impacts on competitive advantage.*

Statistically expressed as $H1_A$: $p_{I\text{-}C} < 0.05$

As can be deduced from Figure 19, the calculated significant level ($p_{I\text{-}C} < 0.01$) is much less than 0.05, which indicates that ICT utilisation has significant impact on competitive advantage. The interpretation is: if ICT utilisation really has no impact on competitive advantage, the probability of finding a coefficient as large as the least squares ($R^2 = 0.17$) estimate is less than one in a hundred. The analysis further shows that ICT utilisation explained 17% variance ($R^2 = 0.17$) in the dependent variable (competitive advantage). However, it should be noted that squared correlation coefficient (R^2) "always increases as more variables are added to the model, but a very small increase in R^2 may be neither practically not statistically important" (Kleinbaum *et al.*, 2008, p. 123). Therefore, $H1_A$ is substantiated and $H1_0$ is rejected, so the alternate hypothesis is accepted that ICT utilisation has significant impacts on competitive advantage.

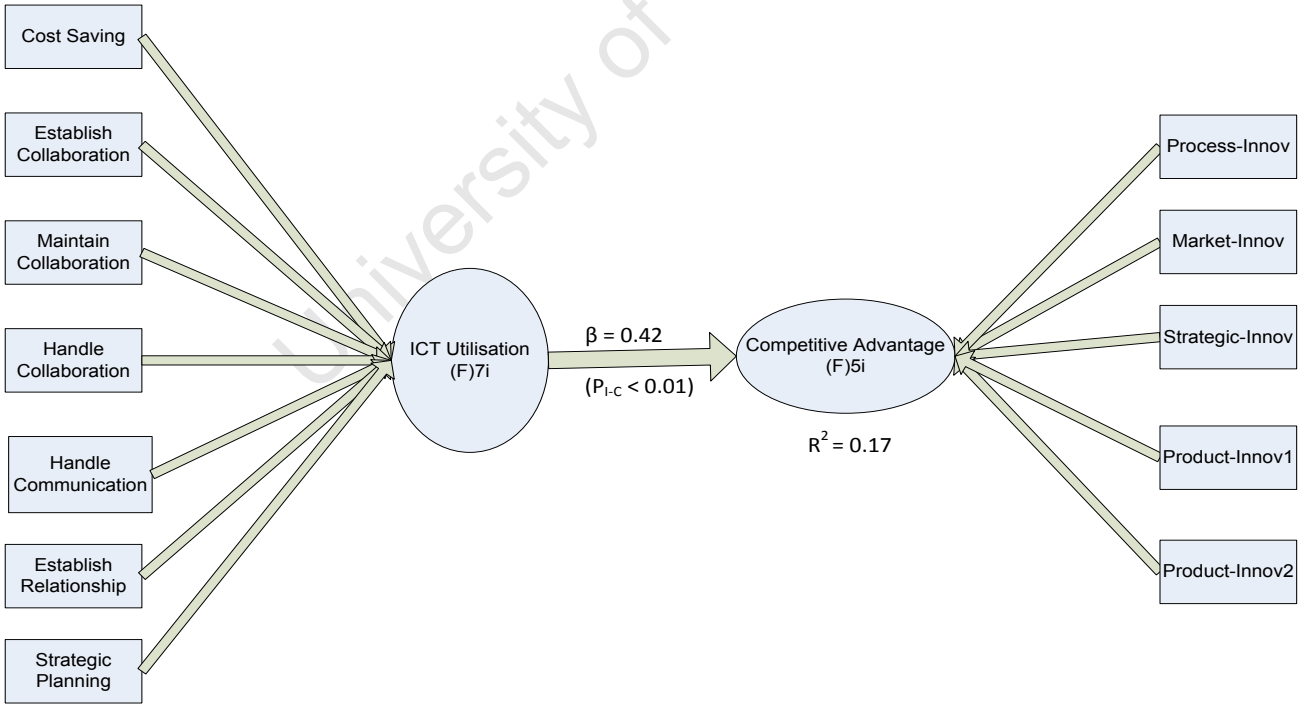

Figure 19: Impacts of ICT utilisation on competitive advantage

4.5.2. Exploratory Research question 2: How do ICT utilisations impact on DCs of South African SMEs in dynamic environments?

Hypothesis 2: Impacts of ICT utilisation on DCs

Hypothesis 2 can be stated in the null ($H2_0$) and alternate ($H2_A$) as follows:

$H2_0$: *ICT utilisation will not have significant impacts on DCs.*

Statistically expressed as $H2_0$: $p_{I\text{-}D} \geq 0.05$

$H2_A$: *ICT utilisation will have significant impacts on DCs.*

Statistically expressed as $H2_A$: $p_{I\text{-}D} < 0.05$

Figure 20 shows that the calculated significant level ($p_{I\text{-}D} < 0.01$) is much less than 0.05, indicating that ICT utilisation has significant impacts on DCs.

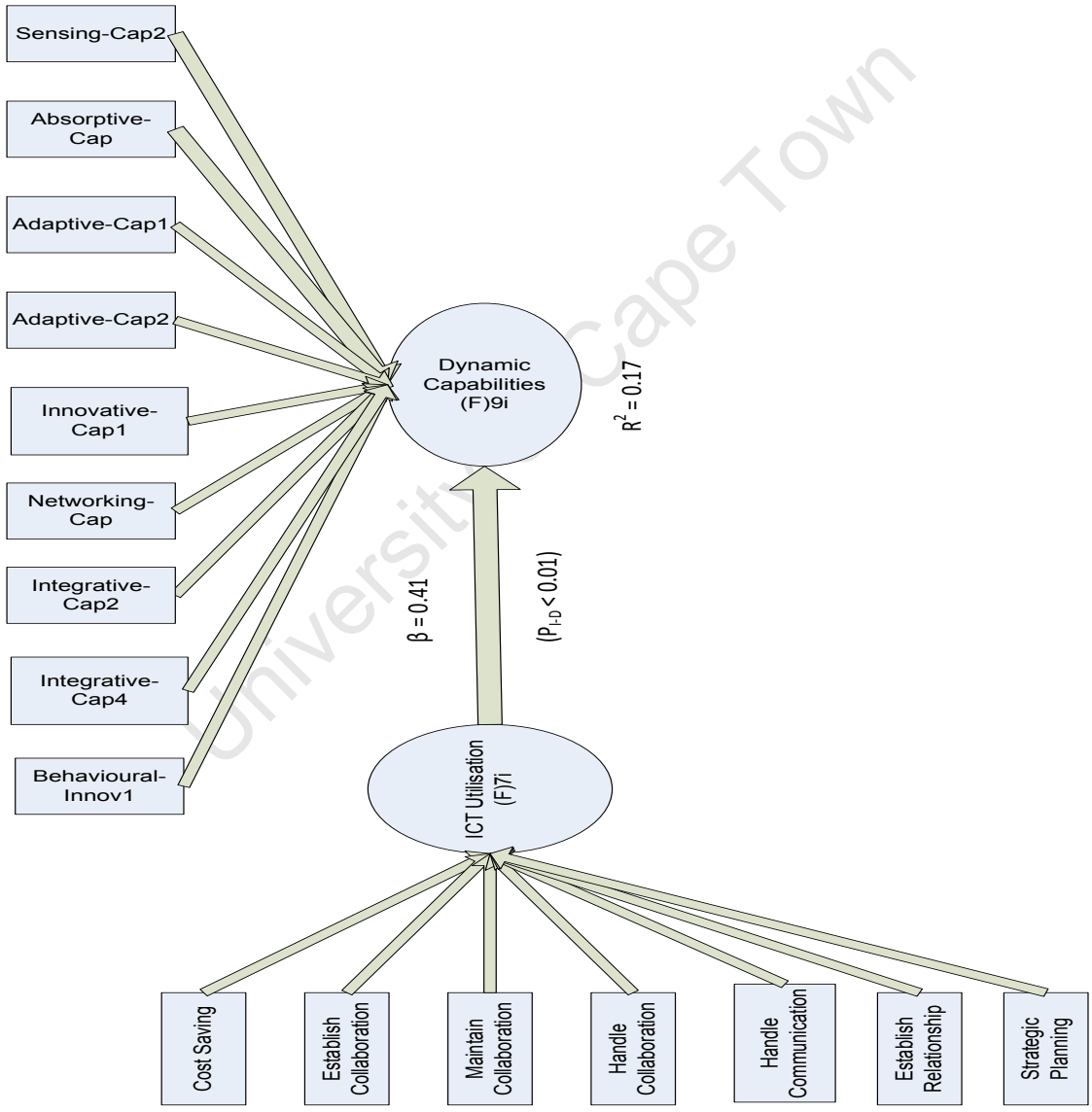

Figure 20: Impacts of ICT utilisation on Dynamic capabilities

The interpretation is: if ICT utilisation really has no impact on DCs, the probability of finding a coefficient as large as or larger than the least squares ($R^2 = 0.17$) estimate is less than one in a

hundred. The analysis further shows that ICT utilisation explained 17% variance ($R^2 = 0.17$) in DCs. Thus, $H2_0$ is rejected and the alternate hypothesis $H2_A$ is accepted that ICT utilisation has significant impacts on DCs.

4.5.3. Exploratory Research question 3: What types of DCs will significantly impact on competitive advantage within the South African SMEs in dynamic environments?

Hypothesis 3: Impacts of DCs on Competitive advantage
Hypothesis 3 can be stated in the null ($H3_0$) and alternate ($H3_A$) as follows:

$H3_0$: Not all DCs will have *significant impacts on competitive advantage.*

Statistically expressed as $H3_0$: $p_{D\text{-}C} \geq 0.05$

$H3_A$: All DCs will have *significant impacts on competitive advantage.*

Statistically expressed as $H3_A$: $p_{D\text{-}C} < 0.05$

As can be deduced from Figure 21, $p_{D\text{-}C} < 0.004$ indicates that all DCs (sensing, absorptive, adaptive, innovative, networking, integrative and behavioural) constructs specified in this analysis are highly significant. The interpretation is: the probability of any of the specified DCs constructs having no impacts on competitive advantage is less than one in two hundred and fifty. The analysis further shows that DCs constructs explain a substantial amount (38%) of variance ($R^2 = 0.38$) in the dependent variable (competitive advantage). Thus, $H3_A$ is substantiated and H_0 is rejected, the alternate hypothesis is accepted that all the DCs specified in the study have significant impacts on competitive advantage.

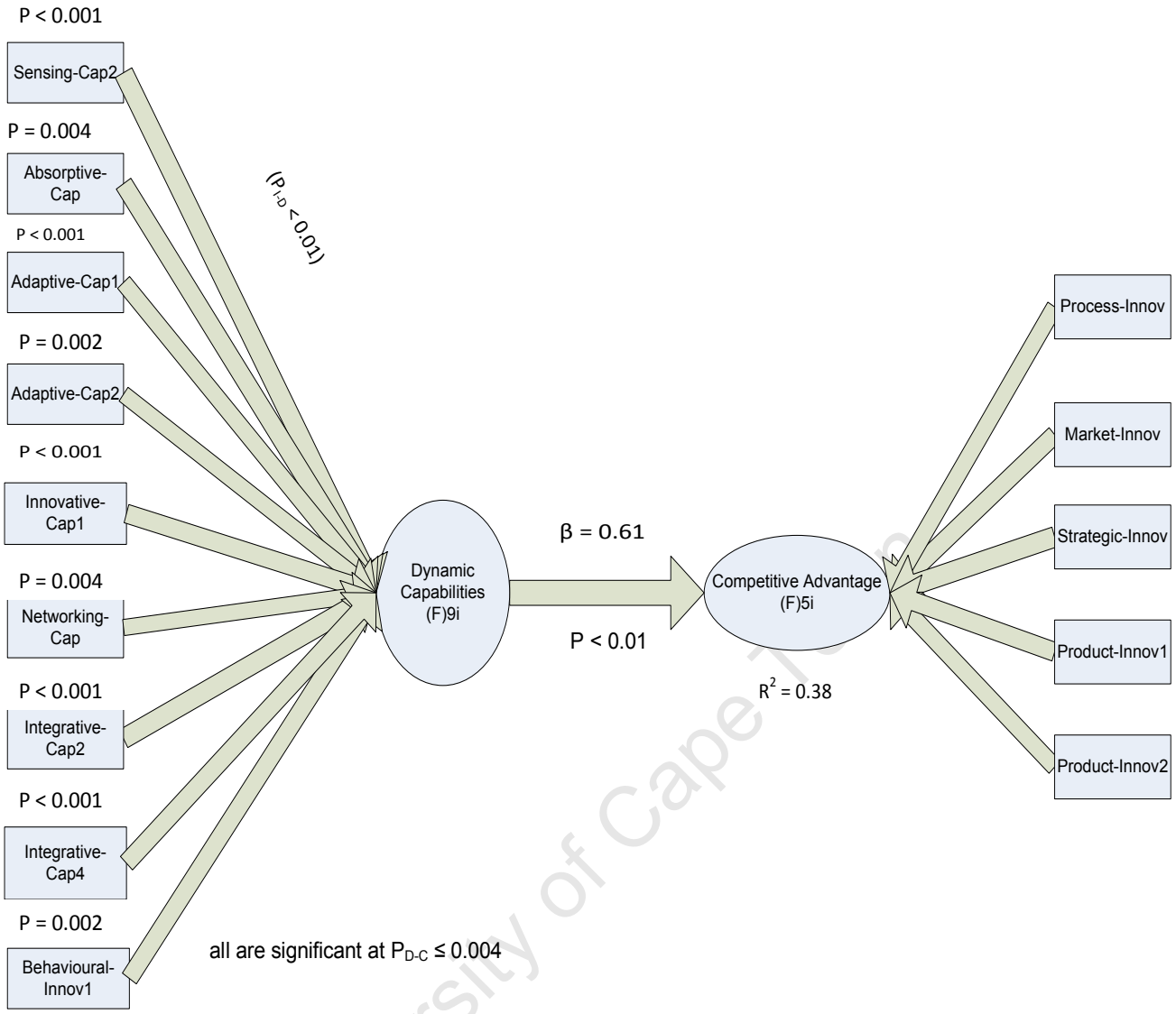

Figure 21: Impacts of Dynamic Capabilities on Competitive advantage

4.5.4. Exploratory Research question 4: How do DCs impact on ICT utilisations of South African SMEs in dynamic environments?

Hypothesis 4: Impacts of DCs on ICT utilisation

Hypothesis 4 can be stated in the null ($H4_0$) and alternate ($H4_A$) as follows:

$H4_0$: *DCs will not have significant impacts on ICT utilisation.*

Statistically expressed as $H4_0$: $p_{D\text{-}I} \geq 0.05$

$H4_A$: *DCs will have significant impacts on ICT utilisation.*

Statistically expressed as $H4_A$: $p_{D\text{-}I} < 0.05$

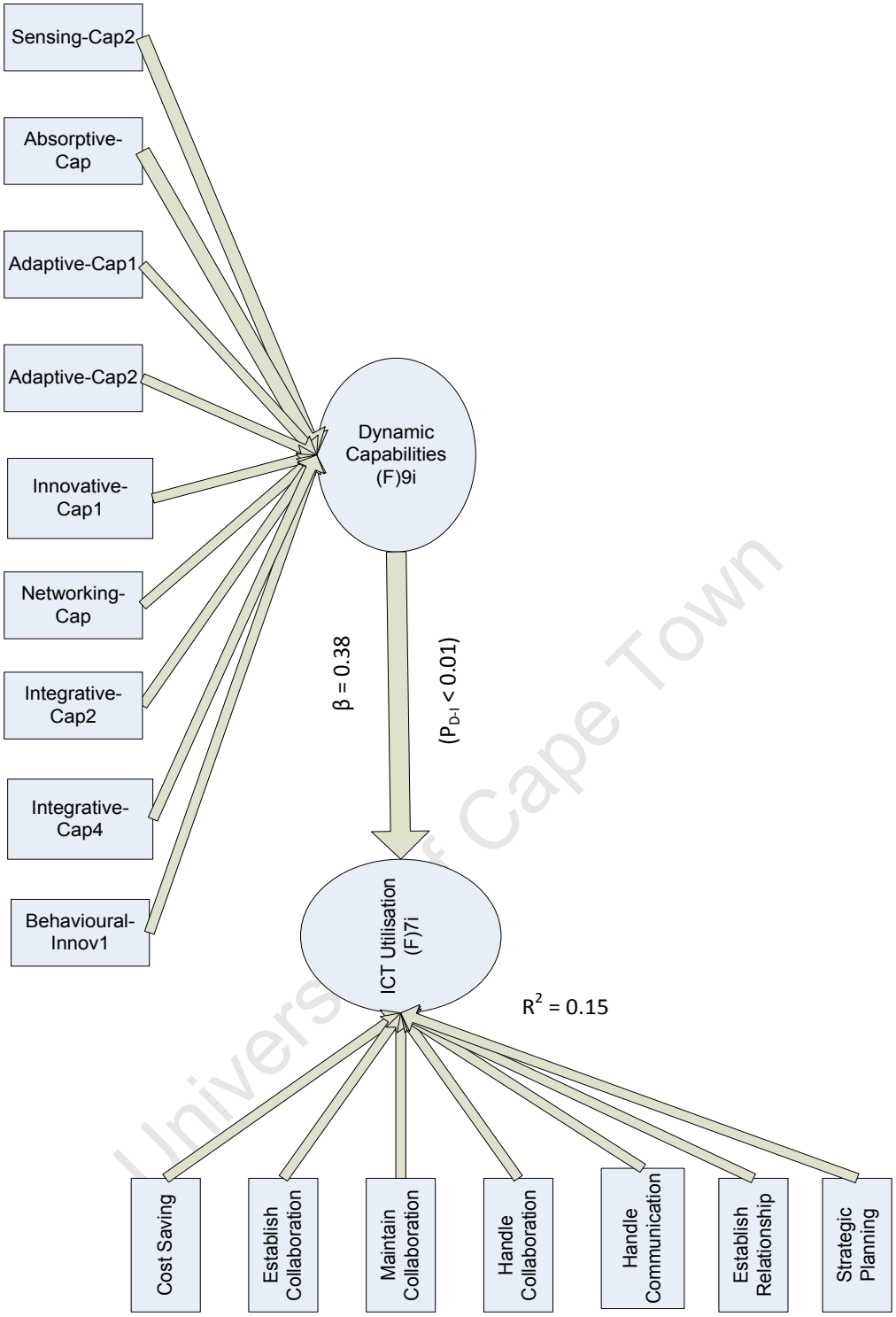

Figure 22: Impacts of Dynamic Capabilities on ICT utilisation

As can be deduced from Figure 22, the calculated significant level ($p_{D-I} < 0.01$) is much less than 0.05, indicating that DCs have significant impacts on ICT utilisation. The interpretation is: if DCs really has no impact on ICT utilisation, the probability of finding a coefficient as large as the least squares ($R^2 = 0.15$) estimate is less than one in a hundred The analysis further shows that DCs

explain 15% variance (R^2 = 0.15) in the dependent variable (ICT utilisation). Therefore, $H4_A$ is substantiated and $H4_0$ is rejected, the alternate hypothesis is accepted that DCs have significant impacts on ICT utilisation.

4.5.5. Exploratory Research question 5: What is the contingent effect of firm size and age on the ICT utilisation, absorptive and innovative capabilities of South African SMEs?

Hypothesis 5: Contingent effects of firm size and age on ICT utilisation, absorptive and innovative capabilities

Hypothesis 5A can be stated in the null ($H5_{A0}$) and alternate ($H5_{Aa}$) as follows:

$H5_{A0}$: *Firm size and age will not have significant impacts on ICT utilisation.*

Statistically expressed as $H5_{A0}$: $p_{S\text{-}I} \geq 0.05$ and $p_{A\text{-}I} \geq 0.05$

$H5_{Aa}$: *Firm size and age will have significant impacts on ICT utilisation.*

Statistically expressed as $H5_{Aa}$: $p_{S\text{-}I} < 0.05$ and $p_{A\text{-}I} < 0.05$

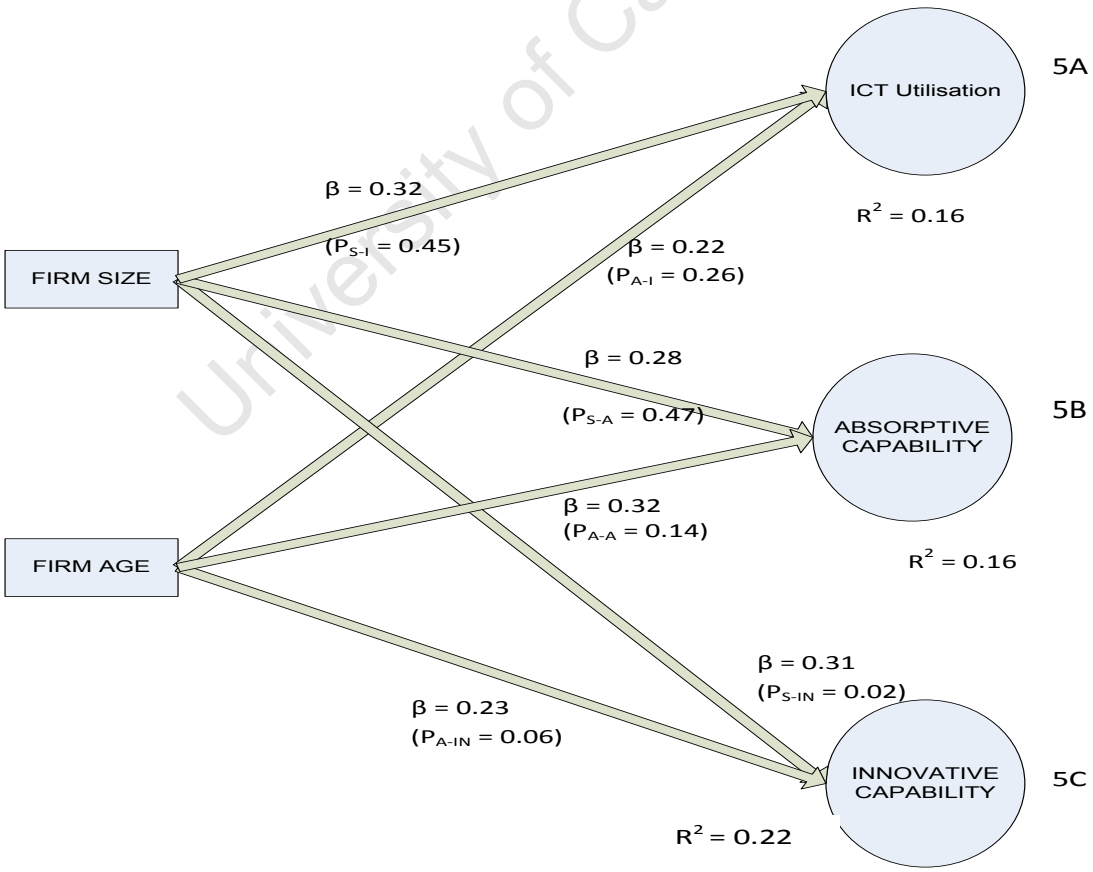

Figure 23: Impacts of firm size and age on ICT utilisation, absorptive and innovative capabilities

From Figure 23, it can be deduced that $p_{S-I} = 0.45$ and $p_{A-I} = 0.26$, the calculated significant level is much greater than 0.05, which indicates that firm size and firm age have no significant impact on ICT utilisation. Therefore the alternative hypothesis ($H5_{Aa}$) is rejected and null hypothesis ($H5_{A0}$) is accepted that firm size and age have no significant impact on ICT utilisation.

Hypothesis 5B can be stated in the null ($H5_{B0}$) and alternate ($H5_{Ba}$) as follows:

$H5_{B0}$: *Firm size and age will not have significant impacts on absorptive capability.*

Statistically expressed as $H5_{B0}$: $p_{S-A} \geq 0.05$ and $p_{A-A} \geq 0.05$

$H5_{Ba}$: *Firm size and age will have significant impacts on absorptive capability.*

Statistically expressed as $H5_{Ba}$: $p_{S-A} < 0.05$ and $p_{A-A} < 0.05$

Figure 23 further shows that $p_{S-A} = 0.47$and $p_{A-A} = 0.14$; the calculated significant level is much greater than 0.05 which indicates firm size and firm age have no significant impact on absorptive capability. Therefore the alternative hypothesis ($H5_{Ba}$) is rejected and null hypothesis ($H5_{B0}$) is accepted that firm size and age have no significant impact on absorptive capability.

Hypothesis 5C can be stated in the null ($H5_{C0}$) and alternate ($H5_{Ca}$) as follows:

$H5_{C0}$: *Firm size and age will not have significant impacts on innovative capability.*

Statistically expressed as $H5_{C0}$: $p_{S-IN} \geq 0.05$ and $p_{A-IN} \geq 0.05$

$H5_{Ca}$: *Firm size and age will have significant impacts on innovative capability.*

Statistically expressed as $H5_{Ca}$: $p_{S-IN} < 0.05$ and $p_{A-IN} < 0.05$

Figure 23 finally shows that $p_{S-IN} = 0.02$ and $p_{A-IN} = 0.06$, the calculated significant level for the impacts of firm size on innovative capability, is less than 0.05 while the calculated significant level for the impacts of firm age on innovative capability is greater than 0.05. These findings indicate that,

while firm age has no significant impact on innovative capability, firm size does. Therefore the hypothesis ($H5_C$) is inconclusive.

4.5.6. Summary of hypotheses

Although only small portions of the variation in the dependent variables were explained, the purpose of the study was to explore the impacts of the independent variables on the dependent variables, not to completely explain either the independent or dependent variables (see Table 20 for an overview of the hypotheses testing). However, as suggested by Falk & Miller (1992), R^2 should be greater than 0.1. It can be deduced from Table 20 that all the dependent variables meet Falk & Miller's (1992) rule of 0.1. Therefore, H1 – H4 were accepted, while H5 was inconclusive. In addition, it can be deduced from Figures 19 – 23 and Table 20 that standardised coefficients (beta - β) for all the dependent variables are positive; this implies that the independent variable, in each case, has positive impact on the dependent variable.

Table 20: Summary of the hypotheses tests

Hypothesis		Independent variable	Dependent variable	β	R^2	p-value	Support
H1		ICT utilisation	Competitive advantage	0.42	0.17	< 0.01	Yes
H2		ICT utilisation	Dynamic capabilities	0.41	0.17	< 0.01	Yes
H3		Dynamic capabilities	Competitive advantage	0.61	0.38	≤ 0.004	Yes
H4		Dynamic capabilities	ICT utilisation	0.38	0.15	< 0.01	Yes
H5	H5a	Firm Size	ICT utilisation	0.32	0.16	0.45	No
		Firm Age		0.22		0.26	No
	H5b	Firm Size	Absorptive capability	0.28	0.16	0.47	No
		Firm Age		0.32		0.14	No
	H5c	Firm Size	Innovative capability	0.31	0.22	0.02	Yes
		Firm Age		0.23		0.06	No

5. Conclusion

The structure of this chapter is as follows: Section 5.1 summaries this research and relates the findings from data analysis and results with relevant literature. Section 5.2 discusses the findings of this research. The last Section 5.3 presents limitation of the study, suggestions for future research and recommendations for practice.

5.1. Summary

This study sets out to investigate how South African SMEs use ICT and DCs to achieve competitive advantage in a changing business environment. As the backbone of the South African economy, SMEs are confronted with competitive forces and challenges which threaten their survival and are characterised by limited resources. South African SMEs fail at the rate of between 70% and 80% and, because SMEs are competing in a dynamic and rapidly changing business environment, South African SMEs need to develop inimitable capabilities that can support business strategies.

Dynamic capability was found to be a useful theoretical approach to investigate how firms achieve and maintain competitive advantage in changing environments. However, the literature on DCs consists largely of conceptual and theoretical studies rather than empirical studies and, while a number of scholars argue that DC alone cannot significantly impact on competitive advantage, or improve a firm's performance, others disagree. Very little empirical work has been undertaken to identify the types of organisational capabilities or DCs that can assist SMEs to achieve competitive advantage, or the impacts of ICT utilisation and DCs on competitive advantage, in the developing countries context.

This study provided empirical evidence through an online based semi-structured questionnaire to clarify the notion, and to investigate the impacts of ICT utilisation and DCs on competitive

advantage. Data was collected from individuals responsible for IT of South African SMEs in various provinces.

5.2. Findings

Based on the research questions in section 1.3, the key findings of this research will be discussed under the following subheadings:

- Sources of competitive advantage
- Levels and purposes of ICT utilisation
- Effects of firm size and age on ICT capabilities
- Impact of ICT utilisation on competitive advantage
- Impact of ICT utilisation on dynamic capabilities
- The type of dynamic capabilities that can significantly impact on competitive advantage
- Impact of dynamic capabilities on ICT utilisation
- Effects of firm size and age on ICT utilisation, absorptive and innovative capabilities.

5.2.1. Sources of competitive advantage

From the responses received from the open ended questions in section 4.4.1, it was discovered that innovation, networking, adaptive capabilities, behavioural innovativeness and dynamic capabilities generally play crucial roles in achieving competitive advantage. Respondents laid emphasis on behavioural innovativeness, innovation and networking capabilities. The respondents realised the impact innovation plays in retaining customers and maintaining competitive advantage. It was concluded that competitive advantage is obtained through continuous development of VRIN organisational resources (Augier & Teece, 2008; Teece, 2007).

5.2.2. Levels and purposes of ICT utilisation

It was concluded in section 4.4.2 that, regardless of the capability levels, South African SMEs extensively use word processing, spread sheeting, presentation graphics, accounting software, fax machines and fixed lines. Fewer respondents use customer management software, payroll, human resources, ERP and AutoCAD. These findings are comparable with studies conducted by Kew and Herrington (2009) and ECLAC (2005).

Across the three – BIT, AC and AIT – capability levels, within the South African SMEs, the mobile phone is highly used for communication with customers and suppliers, while PCs are highly used for obtaining information and storing information, and for banking. The intranet/internet is highly used for obtaining information, for banking, for purchasing, for marketing, for finding partners locally and internationally, and for new business opportunities.

VoIP and video conferencing are the least used technologies across the three capability levels. However, SMEs under AC capability level use VoIP and video conferencing for communication with customers and suppliers. SMEs under AIT capability level use VoIP to an extent: for obtaining information, for communication with customers and suppliers, for finding partners locally and internationally, and for new business opportunities. SMEs under AIT capability level also use video conferencing for communication with customers and suppliers, and for finding partners locally and internationally.

Lastly, from the additional information provided by the respondents across the three capability levels, it was concluded that South African SMEs are high users of ICT. Most of the ICT applications, tools and computer software programs that were indicated are advanced technologies.

5.2.3. Effects of firm size and age on ICT capabilities

The description in section 4.4.3 clearly indicates that technology related firms (Manufacturing and ICT sectors) use more advanced technology than non-technology related firms. This finding provides support for the observation by Kotelnikov (2007): that Manufacturing firms are more likely to use technology than other sectors and indicates that the level of ICT usage within South African SMEs is sector specific.

Also, these findings show that a firm's size has significant impacts on ICT capabilities, with the medium size firms having AIT capability. A firm's age also impacts on the level of ICT capability of South African SMEs, the more mature firms having AIT capability. This result is consistent with the literature – Sawer *et al.* (2008) indicated that medium sized firms have greater capabilities than small firms.

5.2.4. Impact of ICT utilisation on competitive advantage

It is not surprising that the literature says ICT can contribute significantly to SMEs (Kew & Herrington, 2009). From hypothesis – H1 (Figure 19 and Table 20), it was concluded that ICT utilisation has significant and positive impacts on competitive advantage. This implies that effective use of ICT can provide SMEs with opportunities over their competitors. This finding indicates that the ability of ICT to provide SMEs with competitive advantage lies in its usage, not just in mere possessing of ICT tools, applications or functions.

This finding is consistent with the literature: the resources (ICT) that will provide SMEs with competitive advantage must be transformed into capabilities (Borch & Madsen, 2007). ICT can enable SMEs to achieve more with less; this will facilitate price reduction and enable SMEs to remain competitive (Newbert, 2008).

5.2.5. Impact of ICT utilisation on dynamic capabilities

Studies show that ICT utilisation can enhance a firm's capabilities (Gago & Rubalcaba, 2007; Lin, 2007). This is supported by hypothesis – H2 (Figure 20 and Table 20). These findings indicate that ICT utilisation has significant and positive impacts on DCs. ICT utilisation can enable SMEs to respond quickly to new opportunities and provide SMEs with the required flexibility to respond to environmental opportunities and pressures. ICT utilisation can create intimacy between SMEs and their customers, thus enabling them to be sensitive to the customers' needs or immediate demands.

5.2.6. The types of dynamic capabilities that can significantly impact on competitive advantage

From the constructs validity tests in section 4.3.3, it was found that sensing, absorptive, adaptive, innovative, networking and integrative capabilities, as well as behavioural innovativeness, loaded on Factor 1 (DC). This result indicates that all the DCs specified in this study are part of DC constructs. This study extends DC literature to include sensing and integrative capabilities and behavioural innovativeness. This findings confirms the literature (Jusoh & Parnell, 2008; Lindblom *et al.*, 2008; Morgan *et al.*, 2009; Parida, 2008; Wang & Ahmed, 2007), and disproves Ambrosini and Bowman's (2009, p.36) argument that sensing capability is not DC, but is "managerial and organisational processes that underpin and enable the deployment of dynamic capabilities".

Sensing capability can enable SMEs to capitalise on new opportunities and to respond quickly to customers' needs and the business environments, ahead of rivals. SMEs with sensing capability will be able to demonstrate anticipatory skills and predict customers' response to change ahead of rivals.

Integrative capability can assist SMEs to adequately put into use all its resources to generate long-time returns in changing environments. SMEs with integrative capability will be able to use past

experiences, resources and capabilities to manage both internal and external changes, ahead of competitors.

Behavioural innovativeness (now referred to as behavioural capability) is the ability of SMEs to embrace a culture that motivates the introduction of new concepts, new processes and new strategies and that can be sustained over time to achieve competitive advantage. Behavioural capability is the ability to motivate individuals, teams and management to new ways of doing things in a changing business environment.

It can also be deduced from hypothesis – H3 (Figure 21 and Table 20), that all the DC constructs are highly significant, which indicates that all the constructs have significant roles to play in achieving competitive advantage. However, the level of significance of each of the constructs differs. Figure 21 further shows that sensing, adaptive, networking and integrative capabilities are most significant.

Therefore, DCs are capable of influencing a firm's VRIN resources to achieve competitive advantage in a fast changing business environment (Ambrosini & Bowman, 2009). The empirical findings largely indicate that DCs have positive impacts on competitive advantage, and that SMEs need to go beyond the level of acquiring resources and move to the level of transforming the resources to capabilities, in order to remain competitive in a changing environment.

5.2.7. Impacts of dynamic capabilities on ICT utilisation

From hypothesis – H4 (Figure 22 and Table 20), it was concluded that DCs have significant and positive impacts on ICT utilisation. These findings show that DCs will enable SMEs to respond quickly to acquire and utilise a new technology, while responding to environmental opportunities and pressures ahead of rivals. DCs will assist SMEs to generate long-time returns on ICT applications, functions and tools in a changing environment, and make SMEs effectively use ICT to meet the

needs, goals and objectives of the organisation. In addition, DCs will help SMEs to effectively predict future technological development, advance in technological fields and out-perform competitors (Wetter & Delmar, 2007). DCs will allow SMEs to effectively manage technological changes, expose SMEs to new technologies and new business strategies, and enable SMEs to embrace new technologies easily (Sawers *et al.*, 2008).

5.2.8. Contingent effects of firm size and age on ICT utilisation, absorptive and innovative capabilities

The result of hypothesis – H5 is inconclusive. This hypothesis is only substantiated for the effects of firm size and age on innovative capability. Firm size and age show no significant impacts on ICT utilisation and absorptive capability. Sawer *et al.* (2008) indicated that medium sized firms have greater capabilities than small firms. This result shows that firm size has significant impacts on innovative capability, but this cannot be generalised to all capabilities, because firm size and age do not show any significant impacts on ICT utilisation and absorptive capability. This finding is consistent with the study conducted in Sweden where firm size shows significant impacts on ICT utilisation but firm age does not (Parida *et al.*, 2009).

5.3. Limitations and Recommendations

5.3.1. Limitations of study

This study has two major limitations. The first limitation is the small sample size. Although the size is sufficient enough for the hypothesis testing, a larger sample size could have increased the accuracy of the study. The second limitation is that this study confines its view of competitive advantage to innovativeness of SMEs.

5.3.2. Suggestions for future research

This study may be regarded as a basic step to understanding DCs within the SMEs. Researchers are therefore encouraged to further:

1. Extend competitive advantage beyond innovativeness and investigate, beyond the modified conceptual framework (Figure 25), what gives SMEs competitive advantage in changing environments.
2. Use case studies to investigate how SMEs use ICT and DCs to achieve competitive advantage.
3. Examine the contingency effects of firm size and firm age on DCs and competitive advantage of SMEs.
4. Consider the moderating effects of firm size and age on DCs and ICT utilisation.
5. Consider the moderating effects of ICT utilisation on DCs and competitive advantage.

5.3.3. Recommendations for practice

This study shows that South African SMEs are high users of ICT, and that ICT can enhance SMEs' DCs and assist SMEs to achieve competitive advantage in changing business environments. However, the high costs of internet access, cost of telecoms, hardware and software inhibit many SMEs from using advanced technologies, and awareness of potential benefits of using internet was found to be low among SMEs (Kew & Herrington, 2009).

In order to reduce the failure rate of newly established firms, awareness needs to be created regarding the benefits related to extensive use of advanced technologies. Costs could be reduced by government intervention in reducing customs and excise taxes on ICT, while vendors could increase awareness campaign to SMEs. South African SMEs need to move from the level of acquiring VRIN resources to developing DCs.

SMEs are therefore encouraged to develop sensing, absorptive, adaptive, innovative, networking, integrative and behavioural capabilities to remain competitive. Competitive advantage is not achieved from gathering resources, but from effective usage of ICT and transformation of VRIN resources to capabilities.

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Appendix A: An online questionnaire introductory letter

A Survey on Small and Medium Enterprises (SMEs) capabilities for competitive advantage

You are cordially invited to participate in this survey which is part of the requirements for the degree Master of Commerce in Information Systems. I am a Masters student at the University of Cape Town in the Faculty of Commerce. My research seeks to explore and describe how SMEs in South Africa use Information Technology (IT) for business purposes.

The study involves only individuals responsible for IT of SMEs in South Africa. I would like to request your participation, as an individual responsible for IT by Tuesday 30th of November 2010.

You may need up to 20 minutes to complete the questionnaire. Please be advised that the results of this study will divulge neither the organisation's particulars nor those of individual participants. The data obtained will be treated in strict confidence.

If at any time you feel uncomfortable with your participation in this research, you will be at liberty to opt out. Your participation is completely voluntary. It would be greatly appreciated if you would consider passing this questionnaire to any other individuals who would be willing to participate.

Thank you.

If there are any queries, please direct them to:

Student: tejumade.adeniran@uct.ac.za
Cell: 071 275 5440 OR
Supervisor: kevin.johnston@uct.ac.za
Phone: 021 650 2266

UNIVERSITY OF CAPE TOWN :: FACULTY OF COMMERCE
INFORMATION SYSTEMS

A survey on SMEs capabilities for competitive advantage

Please be advised that the results of the study will divulge neither the organisation's particulars nor those of individual participants. The data obtained will be treated in strict confidence. If at any time you feel uncomfortable with your participation in this research, you will be at liberty to opt out. Your participation is completely voluntary. It would be greatly appreciated if you would consider passing this questionnaire to any other individuals who would be willing to participate. Thank you.

1. Which province in South Africa is your company located?

-- Please Select --

2. When was your company established?

3. What type of industry is your company?

-- Please Select --

Other (please specify)

4. For what purpose do you use the following applications or tools? (Select as many options as apply)

4. For what purpose do you use the following applications or tools? (Select as many options as apply)	Mobile phone	Personal Computer	Intranet / Internet	Website	Voice over Internet Protocol (VoIP)	Video conferencing
Obtaining information	☐	☐	☐	☐	☐	☐
Store information	☐	☐	☐	☐	☐	☐
Banking	☐	☐	☐	☐	☐	☐

4. For what purpose do you use the following applications or tools? (Select as many options as apply)	Mobile phone	Personal Computer	Intranet / Internet	Website	Voice over Internet Protocol (VoIP)	Video conferencing
Purchasing	☐	☐	☐	☐	☐	☐
Marketing	☐	☐	☐	☐	☐	☐
Communication with customers and suppliers	☐	☐	☐	☐	☐	☐
Finding partners locally and internationally	☐	☐	☐	☐	☐	☐
New business opportunities	☐	☐	☐	☐	☐	☐

We are interested in your company's use of information and communication technology (ICT) for different purposes. By ICT we mean all technology used for information and communication purposes such as e-mail, internet, mobile phone, fixed line, intranet, extranet, e-commerce, e-business, Voice over Internet Protocol (VoIP), video conferencing, enterprise resources planning (ERP), customer relationship management (CRM), etc.

5. To what extent does your company use ICT in these areas?

5. To what extent does your company use ICT in these areas?	Not at all	Very rarely	Neutral	Occasionally	To a very large extent
To establish business collaborations with new partners	○	○	○	○	○
To maintain collaboration with existing business partners	○	○	○	○	○
To handle collaboration within the firm (e.g. intranet)	○	○	○	○	○
To handle external communication with the firm's stakeholders (e.g. extranet)	○	○	○	○	○

5. To what extent does your company use ICT in these areas?	Not at all	Very rarely	Neutral	Occasionally	To a very large extent
To establish relationship with other organisations					
To handle business transactions					
To enable strategic planning					
To enable cost savings					

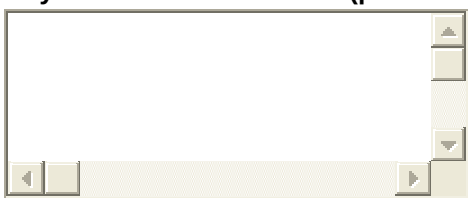
Next

0%

6. Which of the following applications, tools or computer software programs does your organisation use? (Select as many options as apply)

- Word processing
- Spreadsheet
- Presentation graphics (e.g. PowerPoint)
- Accounting software
- Customer management software
- Payroll
- Human resources
- AutoCAD
- Enterprise Resource Planning (ERP)
- Fax machine
- Fixed line

Any additional information (please state)



7. In your company, how often do you.....

7. In your company, how often do you.....	Never	Every two years	Annually	Twice a year	Three times a year
change your business processes?					
introduce new marketing concept?					
introduce a new business strategy?					
market new products / services?					
introduce innovative products / service?					

8. How many employees does your company have?

-- Please Select --

This section deals with how your company reacts to market change. By market change we mean change in customers' need, change in technology, change in economic conditions, etc.

9. In our company,.....

9. In our company,.....	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
we are often cognisant / aware of market change ahead of our rivals					
we often use market information to improve business performance ahead of our competitors					
we often use external information to transform our business processes					
we are flexible enough to respond quickly to changes in customers need and changes in business environments					
we adapt quickly to shifts in our business goals / strategies					
we encourage people to challenge old traditions / practices					
we encourage individual / team / management's willingness to new ways of doing business					
we are willing to take technology related risks					

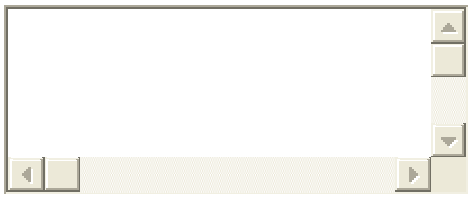
Next Back

33%

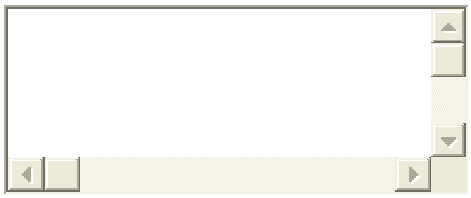
10. In our company,.....

10. In our company,.....	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
we are willing to try new and innovative ways of doing business					
we often introduce new products / services which are at the cutting edge of technology					
we embrace new technologies easily					
we are able to combine newly acquired knowledge with our existing knowledge successfully					
we often combine external resources / knowledge with internal resources / knowledge to meet the goals and objectives of the firm					
we are able to manage both internal and external changes					
we partner with other organisation(s)					

11. What gives you an advantage over your competitors / rivals?



12. Is there any other information you would like to add?



13. Should you wish to receive the results of this survey please provide your email address:

Submit Back

100%

Thank You!

Thank you for your time and participation in this survey.

Appendix B: Commerce Faculty Ethics in Research Committee

UNIVERSITY OF CAPE TOWN

Commerce Faculty Ethics in Research Committee

Any individual in the Faculty of Commerce at the University of Cape Town undertaking any research that involves the use of human subjects, or research that may hold ethical consequences for the University of Cape Town, is required to complete this form. The completed form should be submitted to departmental Ethics Committee representatives for submission to the Commerce Faculty Ethics in Research Committee

1. PROJECT DETAILS	
Project title:	An investigation of how South African Small and Medium Enterprises use ICT and Dynamic Capabilities to achieve competitive advantage
Principal Researcher/s: Adeniran Tejumade	**Research Supervisor / Co-researchers:** Prof. Kevin Johnston
E-Mail Address: tejumade.adeniran@uct.ac.za	kevin.johnston@uct.ac.za
Brief description of the project: An investigation of how South African Small and Medium Enterprises use ICT and Dynamic Capabilities to achieve competitive advantage	
Research methods and procedure: **(please tick and explain procedure)** □ **Interviews** □ Survey questionnaire □ **Experiment** □ **Secondary data** □ **Observation** □ **Other (please specify):**	
2. PARTICIPANTS	

Characteristics of participants:

Gender: The survey questionnaire will be sent to managers of Small and medium enterprises in South Africa. There is neither gender, race, ethic group nor age questions in this study.

Race/Ethnicity

Age rage:

Locati0n South Africa

Other

Affiliations of participants: **(please tick)**

□ Company employees □ **Hospital employees** □ **General public** □ **Military staff** □ **Farm workers** □ **Students** □ **Other (specify)**

Neither minors, mentally challenged nor legally restricted groups of people will be consciously incorporated in this study.

If your sample includes children (aged 15 and below), mentally incompetent persons, or legally restricted groups please explain on a separate page why it is necessary to use these particular groups

3. ORGANISATIONAL PERMISSION

If your research is being conducted within a specific organisation, please state how organisational permission will be obtained: **NA**

4. INFORMED CONSENT

What type of consent will be obtained from study participants?

Oral consent

Written consent

Anonymous survey questionnaire (covering letter required, no consent form needed)

Other (specify): _____

How and where will consent/permission be recorded? NA

If subjects are minors or mentally incompetent, describe on a separate page how and by whom permission will be granted?

5. CONFIDENTIALITY OF DATA

What precautions will be taken to safeguard identifiable records of individuals? Please describe specific procedures to be used to provide confidentiality of data by you and others, in both the short and long run. This question also applies if you are using secondary sources of data.

No identifiable information will be asked. All data will be stored on my personal computer and protected with a password. I will back data up to my flash drive once a week.

6. RISK TO PARTICIPANTS

Does the proposed research pose any physical, psychological, social, legal, economic, or other risks to study participants you can foresee, both immediate and long range? (tick one)

□ Yes □ **No**

If yes, answer the following questions on a separate page:

Describe in detail the nature and extent of the risk and provide the rationale for the necessity of such risks

Outline any alternative approaches that were or will be considered and why alternatives may not be feasible in the study

7. intended dissemination of research findings

Have you discussed authorship issues with your co-researchers or supervisor? (tick one)

□ **Yes** □ No

If yes, what did you agree? Any publications resulting from my Masters will be co-authorship with myself as the first author.

I certify that that the material contained herein is truthful and that all co-researchers and supervisors are aware of the contents thereof:

Applicant's signature:  Date: 13 October 2010

For Ethics committee representative only **Recommendation:** **Date:**	**Signature:**
For Ethics committee CHAIRPERSON only **Recommendation:** **Signature:** **Date:**	

Appendix C: Statistical tests of constructs

Correlation of ICT utilisation constructs

Table 21: A Spearman rank order correlation of ICT utilisation constructs

Spearman Rank Order Correlations (SA Data) MD pairwise deleted Marked correlations are significant at *p <.05000, **p <.0100, ***p <.00100									
	Variable	1	2	3	4	5	6	7	8
1	Cost saving	1.0000							
2	Establish collaboration	0.5518***	1.0000						
3	Maintain collaboration	0.4610***	0.5455***	1.0000					
4	Handle collaboration	0.4847***	0.3517**	0.4120***	1.0000				
5	Handle communication	0.4790***	0.1717	0.3462**	0.6212***	1.0000			
6	Establish relationship	0.5227***	0.5231***	0.6175***	0.4288***	0.4741***	1.0000		
7	Handle transaction	0.3929**	0.2688*	0.2426	0.2725*	0.3367**	0.4458***	1.0000	
8	Strategic planning	0.4686***	0.4623***	0.3687**	0.2782*	0.3261**	0.4706***	0.3841**	1.0000

Correlation of DC constructs

Table 22: A Spearman Rank Order Correlation of Dynamic capability constructs

Spearman Rank Order Correlations (SA Data) MD pairwise deleted Marked correlations are significant at *p <.05000, **p <.00500, ***p <.00100													
	Constructs	1	2	3	4	5	6	7	8	9	10	11	12	13
1	**Sensing-Cap1**	1.0000												
2	**Sensing – Cap2**	0.7414***	1.0000											
3	**Absorptive-Cap**	0.4522***	0.5003***	1.0000										
4	**Adaptive-Cap1**	0.4629***	0.4849***	0.3673**	1.0000									
5	**Adaptive – Cap2**	0.4663***	0.4435***	0.5796***	0.6798***	1.0000								
6	**Innovative-Cap1**	0.5584***	0.6036***	0.5244***	0.5651***	0.6625***	1.0000							
7	**Innovative – Cap2**	0.3295**	0.3081*	0.4369***	0.3209**	0.4781***	0.5354***	1.0000						
8	**Networking-Cap**	0.2561*	0.2763*	0.3035*	0.4940***	0.3660**	0.5135***	0.2967*	1.0000					
9	**Integrative-Cap1**	0.4441***	0.4455***	0.5294***	0.4350***	0.5855***	0.7788***	0.5624***	0.4078***	1.0000				
10	**Integrative – Cap2**	0.4410***	0.4456***	0.4173***	0.4533***	0.6020***	0.6466***	0.6068***	0.2909*	0.6642***	1.0000			
11	**Integrative – Cap3**	0.5443***	0.5762***	0.4838***	0.4338***	0.5768***	0.6746***	0.5870***	0.3066*	0.5963***	0.7203***	1.0000		
12	**Integrative – Cap4**	0.5221***	0.6388***	0.5125***	0.6186***	0.5980***	0.6788***	0.4816***	0.4096***	0.6229***	0.6048***	0.8239***	1.0000	
13	**Integrative -Cap5**	0.4618***	0.5144***	0.5222***	0.6448***	0.7026***	0.7248***	0.4711***	0.4413***	0.6404***	0.6497***	0.8040***	0.8501***	1.0000

Table 23: DCs to be used for reliability and validity tests

Spearman Rank Order Correlations (SA Data) MD pairwise deleted Marked correlations are significant at *p <.0500, **p <.00100

Variable	Sensing-Cap2	Absorptive-Cap	Adaptive-Cap1	Adaptive-Cap2	Innovative-Cap1	Innovative-Cap2	Networking-Cap	Integrative-Cap2	Integrative-Cap4
Sensing-Cap2	1.0000								
Absorptive-Cap	0.5003**	1.0000							
Adaptive-Cap1	0.4849**	0.3673*	1.0000						
Adaptive-Cap2	0.4435**	0.5796**	0.6798**	1.0000					
Innovative-Cap1	0.6036**	0.5244**	0.5651**	0.6625**	1.0000				
Innovative-Cap2	0.3081*	0.4369**	0.3209*	0.4781**	0.5354**	1.0000			
Networking-Cap	0.2763*	0.3035*	0.4940**	0.3660*	0.5135**	0.2967*	1.0000		
Integrative-Cap2	0.4456**	0.4173**	0.4533**	0.6020**	0.6466**	0.6068**	0.2909*	1.0000	
Integrative-Cap4	0.6388**	0.5125**	0.6186**	0.5980**	0.6788**	0.4816**	0.4096**	0.6048**	1.0000

Reliability test of all constructs

Table 24: Reliability test of ICT utilisation, Competitive advantage and DC constructs

Summary for scale: Mean=96.3333 Std.Dv.=13.4589 Valid N:60 (SA Data) Cronbach alpha: .915681 Standardized alpha: .918233 Average inter-item corr.: .333276						
Variable Name	Constructs	Mean if – deleted	Var. if – deleted	StDv. if – deleted	Itm-Totl - Correl.	Alpha if – deleted
Competitive advantage	Process-Innov	93.86667	162.4822	12.74685	0.548914	0.912054
	Market-Innov	92.95000	157.7808	12.56108	0.683931	0.909101
	Strategic-Innov	93.26667	160.6289	12.67395	0.652305	0.909951
	Product-Innov1	92.78333	162.8697	12.76204	0.499144	0.913219
	Product-Innov2	92.70000	161.7433	12.71784	0.563334	0.911768
	Behavioural-Innov1	92.30000	162.4767	12.74663	0.610120	0.910870
	Behavioural-Innov2	92.10000	162.0900	12.73146	0.712924	0.909345
ICT utilisation	Cost saving	91.88333	167.1697	12.92941	0.389369	0.915161
	Establish collaboration	91.90000	166.1567	12.89018	0.430735	0.914354
	Maintain collaboration	91.65000	169.0608	13.00234	0.493814	0.913334
	Handle collaboration	92.05000	165.2142	12.85357	0.401775	0.915447
	Handle communication	92.01667	167.2497	12.93251	0.338496	0.916696
	Establish relationship	91.85000	165.9275	12.88128	0.526399	0.912519
	Handle transaction	91.60000	174.4400	13.20757	0.221360	0.916684
	Strategic planning	92.16666	167.7722	12.95269	0.345869	0.916198
DCs	Sensing-Cap2	92.26667	164.7955	12.83727	0.534665	0.912320
	Absorptive-Cap	92.51667	161.3831	12.70366	0.678440	0.909640
	Adaptive-Cap1	92.11667	163.3697	12.78162	0.638937	0.910566
	Adaptive-Cap2	92.31667	162.1164	12.73249	0.691911	0.909609
	Innovative-Cap1	92.11667	161.9031	12.72411	0.675997	0.909774
	Innovative-Cap2	92.46667	161.2489	12.69838	0.619601	0.910602
	Networking-Cap	92.35000	165.8275	12.87740	0.410782	0.914961
	Integrative-Cap2	92.28333	162.8697	12.76204	0.626917	0.910651
	Integrative-Cap4	92.15000	163.9275	12.80342	0.675403	0.910260

Factor analysis of all constructs

Table 25: Factor analysis of ICT utilisation, Competitive advantage and DC constructs

Factor Loadings (**Varimax normalized**) (SA Data) **Extraction: Principal components (Marked loadings are >.500000)**				
Variable Name	Constructs	Factor – 1	Factor – 2	Factor – 3
DCs	Sensing-Cap2	**0.627664**	0.072161	0.223874
	Absorptive-Cap	**0.577878**	0.457453	0.300924
	Adaptive-Cap1	**0.789423**	0.101027	0.159413
	Adaptive-Cap2	**0.785749**	0.052693	0.324411
	Innovative-Cap1	**0.861456**	0.008414	0.226598
	Innovative-Cap2	**0.518609**	0.071064	0.433172
	Networking-Cap	**0.617592**	0.249558	-0.200165
	Integrative-Cap2	**0.662714**	0.043277	0.390365
	Integrative-Cap4	**0.788207**	0.100470	0.232141
	Behavioural-Innov1	**0.707534**	0.171288	0.143396
	Behavioural-Innov2	**0.763712**	0.155379	0.285060
ICT utilisation	Cost saving	0.068999	**0.664164**	0.106457
	Establish collaboration	0.175883	**0.672575**	0.058660
	Maintain collaboration	0.330684	**0.603518**	-0.007432
	Handle collaboration	-0.017916	**0.750128**	0.160164
	Handle communication	0.057831	**0.649888**	0.040103
	Establish relationship	0.350365	**0.686816**	-0.030975
	Handle transaction	-0.067624	0.311905	0.294270
	Strategic planning	-0.035956	**0.677651**	0.183944
Competitive advantage	Process-Innov	0.177110	0.320223	**0.619700**
	Market-Innov	0.434084	0.147645	**0.704490**
	Strategic-Innov	0.387295	0.271341	**0.578949**
	Product-Innov1	0.183378	0.046678	**0.785269**
	Product-Innov2	0.298611	-0.007529	**0.797944**
Expl.Var		5.864123	6.169647	3.831470
Prp.Totl		0.254962	0.257069	0.159645

Table 26: Correlation of emerged DC constructs

Spearman Rank Order Correlations (SA Data) MD pairwise deleted Marked correlations are significant at *p <.0500, **p <.00100									
	Sensing-Cap2	Absorptive-Cap	Adaptive-Cap1	Adaptive-Cap2	Innovative-Cap1	Networking-Cap	Integrative-Cap2	Integrative-Cap4	Behavioural-Innov1
Sensing-Cap2	1.0000								
Absorptive-Cap	0.5003**	1.0000							
Adaptive-Cap1	0.4849**	0.3673**	1.0000						
Adaptive-Cap2	0.4435**	0.5796**	0.6798**	1.0000					
Innovative-Cap1	0.6036**	0.5244**	0.5651**	0.6625**	1.0000				
Networking-Cap	0.2763*	0.3035*	0.4940**	0.3660**	0.5135**	1.0000			
Integrative-Cap2	0.4456**	0.4173**	0.4533**	0.6020**	0.6466**	0.2909*	1.0000		
Integrative-Cap4	0.6388**	0.5125**	0.6186**	0.5980**	0.6788**	0.4096**	0.6048**	1.0000	
Behavioural-Innov1	0.4425**	0.5960**	0.4853**	0.6311**	0.5960**	0.4789**	0.4065**	0.4973**	1.0000
Behavioural-Innov2	0.4677**	0.6180**	0.5316**	0.7118**	0.6626**	0.3530**	0.5855**	0.6185**	0.7840**

Appendix D: Characteristics of responses

Table 27: Characteristics of responses

	Descriptive Statistics of responses			
	Variable	Definition	Mean	Std.Dev.
Competitive Advantage	Process-Innov	change business processes	2.492308	1.017397
	Market-Innov	introduce new marketing concept	3.437500	1.125110
	Strategic-Innov	introduce a new business strategy	3.076923	1.004796
	Product-Innov1	market new products / services	3.615385	1.113726
	Product-Innov2	introduce innovative products / service	3.676923	1.062245
ICT utilisation	Cost saving	enable cost savings	4.446154	0.984739
	Establish collaboration	establish business collaborations with new partners	4.369231	1.069013
	Maintain collaboration	maintain collaboration with existing business partners	4.693548	0.667481
	Handle collaboration	handle collaboration within the firm	4.307692	1.102881
	Handle communication	handle external communication with the firm's stakeholders	4.369231	1.083531
	Establish relationship	establish relationship with other organisations	4.461538	0.849208
	Strategic planning	enable strategic planning	4.138462	1.028909
DCs	Sensing-Cap2	use market information to improve business performance	4.092308	0.913836
	Absorptive-Cap	use external information to transform business processes	3.846154	0.922476
	Adaptive-Cap1	respond quickly to changes in customers need and changes in business environments	4.200000	0.851469
	Adaptive-Cap2	adapt quickly to shifts in our business goals / strategies	4.061538	0.863802
	Innovative-Cap2	introduce new products / services which are at the cutting edge of technology	3.907692	0.995664
	Networking-Cap	partner with other organisation(s)	4.015385	1.053155
	Integrative-Cap2	embrace new technologies easily	4.046154	0.891466
	Integrative-Cap4	combine external resources / knowledge with internal resources / knowledge to meet the goals and objectives of the firm	4.184615	0.788438
	Behavioural-Innov1	encourage people to challenge old traditions / practices	4.061538	0.949949
	Behavioural-Innov2	encourage individual / team / management's willingness to new ways of doing business	4.261538	0.834358
Firm size	Size of organisation	use market information to improve business performance	2.276923	1.484374
Firm age	Age of Business Operation	use external information to transform business processes	3.396825	1.276837

Appendix E: ICT capability

1. BIT capability level

BIT: For what purpose do you use the following applications or tools?	Mobile phone	PC	Intranet / Internet	Website	VoIP	Video conferencing
Obtaining information	40%	72%	88%	64%	0%	0%
Store information	28%	96%	40%	32%	0%	0%
Banking	32%	76%	80%	36%	0%	0%
Purchasing	24%	52%	72%	40%	0%	0%
Marketing	36%	48%	72%	76%	0%	0%
Communication with customers and suppliers	72%	64%	56%	60%	0%	0%
Finding partners locally and internationally	20%	52%	72%	56%	0%	0%
New business opportunities	32%	52%	88%	72%	0%	0%

2. AC capability level

AC: For what purpose do you use the following applications or tools?	Mobile phone	PC	Intranet/ Internet	Website	VoIP	Video conferencing
Obtaining information	76%	88%	100%	65%	18%	12%
Store information	47%	100%	59%	29%	0%	0%
Banking	29%	82%	94%	18%	0%	0%
Purchasing	35%	65%	94%	29%	6%	6%
Marketing	41%	71%	94%	82%	6%	12%
Communication with customers and suppliers	94%	59%	88%	65%	59%	47%
Finding partners locally and internationally	24%	59%	94%	53%	24%	35%
New business opportunities	65%	65%	88%	59%	18%	24%

3. AIT capability level

AIT: For what purpose do you use the following applications or tools?	Mobile phone	PC	Intranet / Internet	Website	VoIP	Video conferencing
Obtaining information	65%	91%	91%	83%	48%	26%
Store information	43%	100%	70%	43%	0%	0%
Banking	17%	87%	87%	61%	9%	0%
Purchasing	22%	83%	87%	70%	26%	9%
Marketing	65%	65%	83%	91%	26%	4%
Communication with customers and suppliers	74%	83%	96%	87%	52%	43%
Finding partners locally and internationally	57%	74%	87%	74%	43%	39%
New business opportunities	70%	78%	87%	83%	43%	26%

Appendix F: Overall hypothesis testing and modified conceptual Framework

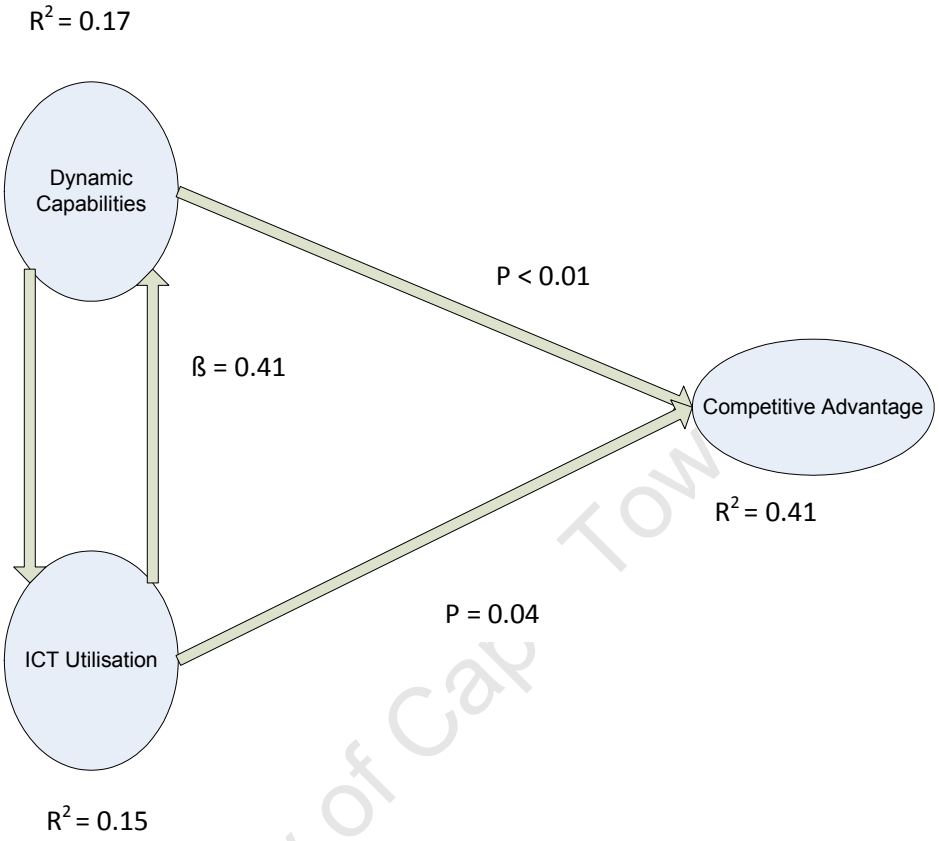


Figure 24: Significant impacts of ICT utilisation and DCs on competitive advantage

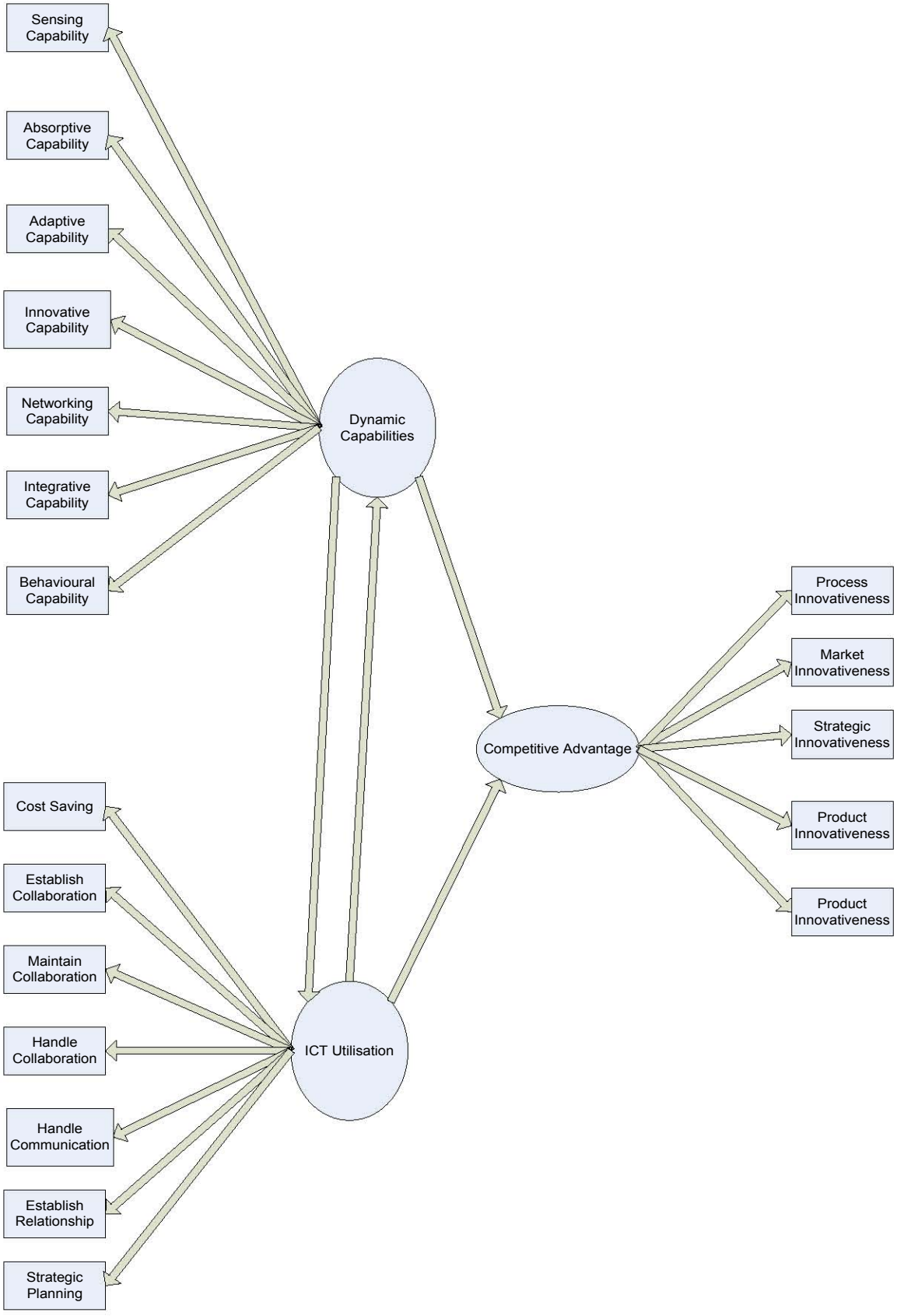


Figure 25: Modified conceptual Framework